POPULAR Computing WEEKLY

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This Week

Exclusive
Tim Langdell reviews the 48K Lynx from Camputers — a low cost micro to rival the Spectrum, Dragon and BBC machines. See page 12

BBC assembler
Can you assemble machine code? Gareth Jones shows you how to make the most of your BBC assembler on page 26

Spectrum unifile
A utility program that enables you to store and manage data. See page 30

Dragon Data
The future of the Dragon. David Kelly travels to Swansea to talk to Tony Clarke, managing director of Dragon Data. See page 10

Vic20 Starfighter
How many enemy starships can you destroy before being overwhelmed? Find out in Terence Wilson's new game for the Vic20 on page 8

News Desk

Sony launches micro-drive

SONY has launched its new 3½ inch micro-floppy disc drive in the UK.

Priced at £235, the new drive could become an industry standard. It operates with two new single sided 3½ inch discs developed by Sony in Japan. The single density disc has a storage capacity of 218 8K at 135 tracks per inch. The double-density disc has a capacity of 437 5K.

The Sony micro floppy drive goes part of the way toward providing the sort of cheap mass storage promised by the Sinclair micro-drive. Quite how successful the Sony disc drive will be depends on development of the necessary disc controllers to enable it to be used with a range of personal computers.

Sony's new 3½-inch microfloppy disc drive

However, before the Sony system can be applied to any of the big selling microcomputers, controllers must be developed.

These disc interfaces allow the computer to access information from and control the operation of the disc drive.

Already Hewlett-Packard has produced such a unit to enable the Sony drive to be used with its range of new personal computers.

Acorn Computers is evaluating the system for use with its BBC machine. A spokesman commented: "We are looking to cut the cost of disc storage for the BBC machine, but a system, if it is to be adopted, would have to be approved both by us, and by the BBC."

Dragon Data currently has no plans to adopt the Sony drive for its micro. Tony Clarke, Dragon's managing director, explained: "The 5¼-inch disc drive Dragon will launch next Spring will include a controller that will only

Continued on page 5

Micro-drive awaits application

THE new Sony £235 micro-floppy disc drive is capable of storing approximately four times as much data as a typical 5¼ inch unit.

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The Team

Editor
Brendon Gore

News Editor
David Kelly [01-930 3271]

Sub-editor
Ninette Sharp

Editorial Secretary
Theresa Lacy

Advertisement Manager
David Lake [01-839 2846]

Advertisement Executive
Alastair Macintosh [01-930 3840]

Managing Editor
Duncan Scot

Publishing Director
Jenny Ireland

Popular Computing Weekly
Hobhouse Court 19 Whitcomb Street
London WC2
Telephone **01-839 6835**

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This Week

Editorial

Copyright is an issue which seems to recur with increasing regularity in the micro world.

Over the past few months, a growing number of programs have appeared based on popular books and tv series such as the *Hitchhiker's Guide to the Galaxy*. Unless permission has been obtained from the author and/or publishers such programs are breaches of copyright.

Little action has been taken so far mainly, I suspect, because most authors and publishers are unaware that these programs exist.

Software companies who want to base programs around books and films must obtain permission first.

While on the subject of copyright, there has also been an increase in the number of software libraries. Many of these libraries, which hire out tapes at about £1 a time pay no royalties to the authors of these programs.

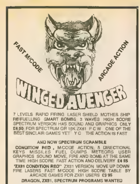
Irrespective of the legal position, software libraries should be morally obligated to pay royalties (preferably at least 20 percent) to program authors. Even the public book lending libraries have finally agreed to this principle.

Next Thursday

Can you defend your base against the maurauding invaders? Find out in Missile Strike — a new game for 16K ZX81 by David Lawrence.

Other features next week include a look at the musical abilities of the Atari, Vic20 and Dragon 32. Jon Chambers compares these modern micros and sees how they measure up to Mozart and Beethoven.

Also next week, Colin McCormick presents a machine code monitor for the Vic20.


FAST M/CODE
ARCADE ACTION
WINGED AVENGER
7 LEVELS RAPID FIRING LASER SHIELD MOTHER SHIP RE-FUELLING SMART BOMBS 3 WAVES HIGH SCORE SPECTRUM VERSION HAS SOUND AND GRAPHICS ONLY £4.50 FOR SPECTRUM OR 16K ZX81 P C W ONE OF THE BEST SINCLAIR GAMES YET Y C THE ACTION IS FAST
AND NOW SPECTRUM SCRAMBLE
CONDITION RED , M/CODE ACTION 8 DIRECTIONAL KEYS MISSILES FUEL DUMPS METEORS USER GRAPHICS SOUND MOVE, FIRE AND BOMB AT THE SAME TIME HIGH SCORE FAST ACTION AND DELIVERY £4 95
"ZX81 CONDITION RED" ZX81 VERSION MOVE UP DOWN FIRE LASERS FAST M/CODE HIGH SCORE TABLE BY ARCADE GAMES FOR ZX81 USERS £3 95
DRAGON, ZX81, SPECTRUM PROGRAMS WANTED
WORK FORCE 140, WILSOEN AVENUE, LUTON, BEDS


PIMANIA

Sharp products and profits increased

TWO new Sharp microcomputers have gone on sale in Japan at the same time as the company has announced increased profits for 1982.

Selling at £175, the MZ-700 has 64K Ram. A colour printer is also available for the computer priced at £85. At about £690, the MZ 3500 has 128K Ram and single disc drive. High sales are anticipated and the Japanese company hopes to produce 20,000 MZ-700s and 5,000 MZ 3500s per month. As yet there are no plans to launch the machines in the UK.

The computers are an extension of Sharp's MZ range. Both of the other MZ computers are available in Britain: the MZ 80A at £549 and the MZ 80B at £1,034 — each with built in cassette drive and display.

The Japanese company has reported interim pre-tax profits up 19.4 percent to over £47m. Full year net profits are expected to top £54m.

Sinclair joysticks for Spectrum

SINCLAIR is to produce its own joystick for the Spectrum microcomputer.

The device will plug into the edge connector on the Spectrum and is of the switching type. It will be able to recognise eight directions and have a fire facility. Software being developed now by Sinclair will be compatible with the new device.

The Sinclair joystick is planned for launch early next year but no price has so far been decided.

Kempston Electronics already market a joystick compatible with the Spectrum which is priced at £19.95.

Sony micro-drive

from page 1

operate up to 80 tracks per inch. With the Sony discs' 135 tracks per inch you would either not be able to use them to full capacity, or you would need to design a new disc operating system to run them. Such a system — a direct memory access system — would cost us about £80. Our 5¼-inch drive will be complete with its own operating system and cost about £250.

Sinclair sceptical

Martin Brenan at Sinclair Research was sceptical that the Sony drives would find application with the Sinclair Spectrum. "Although a floppy-disc based system will be much faster than the Sinclair micro-drive — which has a three second access time — it is also more than four times the price. Our micro-drive when it comes out will revolutionise mass storage thinking."

At £235 for the disc drive plus about £80 for the operating system the Sony micro-floppy would offer 437K of storage.

Cromemco launches new system for £1100

CROMEMCO'S Personal Computer is scheduled to go on sale in the UK by the end of December.

The basic C10 unit is Z80A-based with 64K Ram and 24K Rom, RS232 parallel and serial printer ports. It is supplied with integral 12in green screen monitor but without keyboard for £795. A keyboard is available at £140, a 5¼-inch floppy disc drive costs £395 and a low speed daisy wheel printer is £565.

With a 25 × 80 character display, 20 function keys, four character sets (three text, one graphics) and capable of running CDOS (Cromemco's CP/MR software compatible system) the machine emulates a large-scale unit.

The Personal Computer will be marketed in the UK as the C10 SuperPak. This option includes the C10 unit, keyboard, single disc drive and three software packages. The software packs are the Cromemco Word Processing Pack, 32K Structured Basic and Financial Spreadsheet calculator. The C10 Superpak will cost £1095.

Like the rest of Cromemco's range of microcomputer systems, the Personal Computer will be available from usual UK importers including Microcentre Ltd, 30 Dundas Street, Edinburgh and Comart Ltd, St Neots, Cambridge.

Plans for 50 more IT Centres

INFORMATION TECHNOLOGY Minister Kenneth Baker has announced plans to set up 50 more IT Centres.

This means that 150 centres are now proposed. Of the 100 first planned in 1981, 27 are in operation and 32 more have been finally approved.

The expansion is to go ahead despite criticism that the present IT Centres are lacking in training material. Kenneth Baker said that the IT Centres were "one of the most effective initiatives in post school training".

Youngsters going through the scheme are for the most part without formal educational qualifications and most of the new centres announced will be located in high unemployment city areas.

Kenneth Baker

Dragon Users Group

EVERYONE who buys a Dragon 32 microcomputer is being offered free membership of the Dragon Users Group.

The group is being organised by Dragon themselves and will publish its first free users' newsletter before the end of the year. The issue will feature software and hardware news and programs for the Dragon.

Teletext on BBC micro in January

ACORN has begun manufacture of its teletext adaptor for the BBC microcomputer.

The receiver will only be for use with the BBC Model B machine and will take the form of a hardware/software combination. It will convert the computer to access the teletext system and down-load telesoftware at a rate of 128K per second.

The adaptor has two parts: a main unit which connects to the computer through the 1MHz bus and a plug-in Rom which must be fitted into the computer.

Available in early January, the complete unit will cost £225.

Competition winners

Nick Lambert

ROY Butterfield of Keighley, Yorkshire, has won a Dragon 32 in the *Popular Computing Weekly* Whizzkid '82 competition.

His winning *Auto-Sonics* program provides more than 20 different sound effects for the ZX Spectrum. You can vary the tone and tempo of each sound to create your own individual effects.

The *Auto-Sonics* program was chosen from more than 70 entries by *Popular Computing Weekly* Editor Brendon Gore and Quicksilva's Nick Lambert.

Other programs to be commended in the competition included Kevin Kirkland's *Gobble Garden*, Peter Donn's *Snakes and Ladders* and Silas Patrick's *Woods of Winter* adventure.

A special mention goes to Michael Kern of Paris, our first overseas entrant.

Starfighter

A new game for Vic20
by Terence Wilson

In the aftermath of the Alderean wars, the Galactic Federation has broken up individual star systems have set themselves up as mini empires Communications between the different reaches of the galaxy have broken down

Born on the planet Deneb, you grew up in the shadow of a tyrannical warlord But you were not content to remain a dirt scratcher — one of the planet bound You wanted to become a spacer

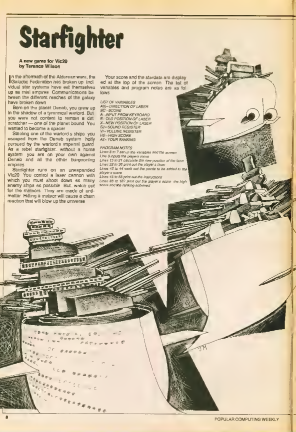
Stealing one of the warlord s ships you escaped from the Deneb system hotly pursued by the warlord s imperial guard As a rebel starfighter without a home system you are on your own against Deneb and all the other burgeoning empires

Starfighter runs on an unexpanded Vic20 You control a laser cannon with which you must shoot down as many enemy ships as possible But watch out for the meteors They are made of anti-matter Hitting a meteor will cause a chain reaction that will blow up the universe

Your score and the stardate are displayed at the top of the screen The list of variables and program notes are as follows

LIST OF VARIABLES
A(I)—DIRECTION OF LASER
SC—SCORE
A—INPUT FROM KEYBOARD
B=OLD POSITION OF LASER
X—NEW POSITION OF LASER
S2=SOUND REGISTER
VI—VOLUME REGISTER
HS—HIGH SCORE
AE=YOUR RANKING

PROGRAM NOTES
Lines 8 to 7 set up the variables and the screen
Line 8 inputs the players move
Lines 13 to 21 calculate the new position of the laser
Lines 22 to 36 print out the player s laser
Lines 42 to 44 work out the points to be added to the player s score
Lines 45 to 83 print out the instructions
Lines 85 to 107 print out the player s score the high score and the ranking achieved



```
 0 A(1)=1:A(2)=22:A(3)=-21:GOSUB57:R=81
 1 U=U+1:S2=36876:Y=30720:CO=36879:
V1=36878:POKECO,14
 2 POKEV1,15:DEFFNR(X)=INT(RND(1)*X+1)
 3 PRINT"":FORI=1TO200:A=FNR(439)+7724:
POKEA,46:POKEA+Y,FNR(6):NEXT:Y=7910
 4 FORI=7702TO7723:POKEI,160:POKEI+Y,1:
POKEI+462,160:POKEI+Y+462,1:NEXT
 5 FORI=7724TO8142STEP22:POKEI,160:POKEI
+Y,1:POKEI+21,160:POKEI+Y+21,1:NEXT:TI$=
"000000"
 6 N=1:C=FNR(439)+7724:IFPEEK(C)<>
160THEN6
 7 PRINT"TIME:"RIGHT$(TI$,3);"
SCORE:"SC
 8 A=PEEK(197):IFA=64OR(A<>17ANDA<>33AND
A<>29ANDA<>30ANDA<>37)THEN30
 9 IFFNR(30)>1THEN12
 10 K=FNR(434)+7724:IFPEEK(K)<>160THEN10
 11 POKEK,42:POKEK+Y,FNR(5)+1
 12 IFA=37THEN38
 13 IFA=17ANDPEEK(X-22)=160THEN30
 14 IFA=33ANDPEEK(X+66)=160THEN30
 15 IFA=29ANDPEEK(X-1)=160THEN30
 16 IFA=30ANDPEEK(X+3)=160THEN30
 17 B=X
 18 IFA=17THENX=X-22
 19 IFA=33THENX=X+22
 20 IFA=29THENX=X-1
 21 IFA=30THENX=X+1
 22 POKEB,32:POKEB+1,32:POKEB+2,32:POKEB
+22,32:POKEB+24,32:POKEB+44,32:POKEB+45,32
 23 POKEB+46,32:B=X
 24 IFPEEK(B)=42ORPEEK(B+1)=42ORPEEK
(B+2)=42ORPEEK(B+22)=42ORPEEK(B+24)=42
THEN48
 25 IFPEEK(B+44)=42ORPEEK(B+45)=42ORPEEK
(B+46)=42THEN48
 26 POKEX,112:POKEX+1,68:POKEX+2,110:
POKEX+22,93:POKEX+24,93:POKEX+44,109:
POKEX+45,70
 27 POKEB+46,125
 28 POKEX+Y,1:POKEX+Y+1,1:POKEX+Y+2,1:
POKEX+Y+22,1:POKEX+Y+24,1:POKEX+Y+44,1
 29 POKEX+Y+45,1:POKEX+Y+46,1
 30 IFN=0THEN35
 31 IFFNP(10)=1THENP=65
 32 IFFNP(20)=1THENP=90
 33 B=A(FNP(3)):IFPEEK(B+C)<>160THEN
POKEC,32:N=0:GOTO7
 34 POKEC,32:C=C+B:POKEC,R:POKEC+Y,
1:GOTO7
 35 N=1:C=FNR(439)+7724:IFPEEK(C)
=160THEN35
 36 IFR=65ORR=90THENR=81
 37 GOTO7
 38 POKECO,120:POKEX+1,66:POKEX+22,67:POK
EX+24,67:POKEX+45,66
 39 FORL=1TO20:FORM=250TO240STEP-1:POKES
2,M:NEXTM:FORM=240TO250:POKES2,M:NEXTM
 40 POKES2,0:NEXTL:POKECO,14
 41 IFR=65ORR=90THENR=81
 42 T=PEEK(X+23):IFT=81THENSC=SC+10:GOTO
46
 43 IFT=65THENSC=SC+100:GOTO46
 44 IFT=90THENSC=SC+1000:GOTO46
 45 GOTO7
 46 POKE36877,220:FORL=15TO0STEP-1:POKEV
1,L:FORM=1TO150:NEXTM:NEXTL:POKE36877,0
 47 POKEX+23,32:POKEV1,15:GOTO35
 48 FORI=8TO255:POKECO,I:NEXT:POKECO,27
 49 PRINT"        STARFIGHTER        "
 50 PRINT" YOU HAVE JUST CAUSED"
 51 PRINT" A SUPER-NOVA TO BLOW"
 52 PRINT" UP THE GALAXY..HOWEVER"
 53 PRINT" YOU DID SURVIVE FOR"
 54 PRINTMID$(TI$,3,2)" MINUTES "RIGHT$
(TI$,2)" SECONDS"
 55 PRINT" AND SCORED";SC(U);"POINTS"
 56 GOSUB86:RESTORE:GOTO95
 57 PRINT"        STAR FIGHTER        "
 58 PRINT"YOU ARE THE COMMANDER"
 59 PRINT"OF A GALACTIC SPACE"
 60 PRINT"ORBITER,AND YOU HAVE"
 61 PRINT"BEEN ATTACKED BY A"
 62 PRINT"FLEET OF ASTRO-MUTANTS"
 63 PRINT"YOUR TASK IS TO SHOOT"
 64 PRINT"THEM WITH YOUR LASER"
 65 PRINT" [.]=FIRE  [/]=RIGHT"
 66 PRINT" [,]=LEFT   [A]=UP"
 67 PRINT"          [Z]=DOWN"
 68 PRINT"HIT A KEY TO COMMENCE"
 69 GETA$:IFA$=""THEN69
 70 PRINT"        STAR FIGHTER        "
 71 PRINT"  YOU HAVE UNLIMITED"
 72 PRINT" TIME TO DO THIS BUT"
 73 PRINT"  YOUR TASK BECOMES"
 74 PRINT"HARDER AS MORE METEORS"
 75 PRINT"APPEAR (*) IF YOU HIT"
 76 PRINT" ONE YOU WILL DESTROY"
 77 PRINT" THE ENTIRE UNIVERSE"
 78 PRINT"AND GOD WILL GET MAD!"
 79 PRINT"POINTS,AS FOLLOWS"
 80 PRINT"  ●=10 POINTS"
 81 PRINT"  ♠=100 POINTS"
 82 PRINT"  ♦=1000 POINTS"
 83 PRINT"  HIT A KEY TO BEGIN"
 84 GETA$:IFA$=""THEN84
 85 RETURN
 86 S2=S2-1
 87 READP
 88 IFP=-1THENRETURN
 89 READD:POKES2,P
 90 FORN=1TOD:NEXT
 91 POKES2,0:FORN=1TO20:NEXT:GOTO87
 92 S2=S2+1:RETURN
 93 DATA195,800,0,80,195,600,0,80,195,200,
195,800,0,80,203,600,201,200,0,80,201,600
 94 DATA195,200,0,80,195,600,0,80,195,200,
0,80,195,1000,-1
 95 PRINT"YOU HAVE ACHIEVED THE"
 96 PRINT"    RANK OF.... .."
 97 IFSC>-1THENA$="       GRANNY"
 98 IFSC>20THENA$="  LOWER COMMANDER"
 99 IFSC>40THENA$="   SPACE CAPTAIN"
 100 IFSC>70THENA$="ADMIRAL OF THE FLEET"
 101 PRINTA$
 102 IFSC>HSTHENHS=SC
 103 PRINT"THE HIGHEST SCORE"
 104 PRINT"    YOUR SCORE:"
 105 PRINTTAB(5)SC
 106 PRINTTAB(5)HS
 107 PRINT"ANOTHER GO (Y/N)?"
 108 GETA$:IFA$<>"N"ANDA$<>"Y"THEN108
 109 IFA$="Y"THEN1
READY.
```

The number of the beast

***David Kelly** talks to Tony Clarke about the Dragon 32 and its prospects.*



Tony Clarke: Dragon managing director designate

That the manufacturer of Corgi model cars should branch out and produce a highly successful microcomputer always seemed faintly bizarre.

And indeed three weeks ago Mettoy was forced to sell more than 60 percent of the Dragon venture to help overcome spiralling debts arising from the collapse of its toy market.

At the time, however, looking out from within Mettoy, the move seemed perfectly natural.

The Dragon 32 was the brain-child of Mettoy director Tony Clarke. Having pursued a dual career as management consultant and electrical engineer — ending as financial director of Mettoy — he was in an ideal position to spot the potential.

Two years ago Tony bought an Apple for himself. "I started to look at what it did — and to compare it with the other machines on the market," he explains. "It struck me that our company could do a better job — in terms of value for money.

Twenty four hour soak testing

"Mettoy is a strange animal. It has enormous resources — machine tool making, plastic moulding, high-volume manufacturing capacity and marketing skills. All the things in fact that infant computer manufacturers lack.

"If you look at most of the British microcomputer manufacturers they do not have the organisational and non-computing skills necessary for producing a high-volume product. They end up subcontracting much of that work out — leading to all sorts of problems.

"Mettoy has 200 plastic moulding machines of various sizes and over 1000 assembly workers used to working on small intricate assemblies."

So Mettoy appeared well placed to produce a computer — especially since it has dabbled in electronic products before — like radio-controlled cars. In addition, Mettoy was very keen to diversify.

The company has shown a financial deficit over the last two years totalling £5.6m, caused by the collapse of its traditional markets. Mettoy has always regarded the three to 14 age range as the purchasers of its toys. In the last couple of years all that has changed. It now sells to three- to eight-year-olds. The over nines now buy electronic goods — computers, video games, tape recorders and televisions.

"So an ex-employee of Mettoy — Gerry Quick (who did a PhD in computer science) and I got together," says Tony. And the result of those discussions formed the basis of what is now called the Dragon.

"I looked at the various available microprocessors. We had a major advantage over other manufacturers in that we were not committed to any particular processor — such as the Z80 or 6502. The 6809 which was chosen for the Dragon was particularly suitable for graphics — its 16 bit register makes them fast. We also chose the SAM (Synchronous Address Multiplexer) chip which carries out many of the functions that would usually go into Rom on a Z80- or 6502-based machine.

"The combination of these two chips makes the computer very cheap to manufacture and very powerful in use.

"We chose Microsoft Basic because it was there — and we didn't have to get the whole of the UK debugging the software in service — all that was already done. Microsoft is very powerful. The 16K Rom gave us all the features we wanted and easy-to-use graphics. We took the version of Basic from Microsoft that is used on the Tandy Colour Computer and wrote our own input/output drivers. That is why the Dragon is faster than the Tandy.

"In September 1981 we pursuaded the Mettoy Board to agree to the manufacture of a prototype — and the PATS Centre in Cambridge was engaged to build it. The Board took a lot of convincing that they should give the go-ahead. In the end I pursuaded them to hold a board meeting down at the 1981 *Personal Computer World* show. They saw hundreds of kids hammering away at keyboards programming micros in ways they couldn't begin to comprehend and they were convinced!

"The prototype was finished at the end of November. When they saw what it could do they gave full agreement to the project and the PATS Centre was contracted to engineer the production."

The Dragon 32 went into production in July this year. Its launch, manufacture and sales have all gone off untarnished by the kind of production difficulties which habitually plague its rivals.

"The reason for that is quite simple," explains Tony. "Mettoy is a manufacturing company. Its whole life is devoted to production in high volume, and we just tapped into that resource. A few thousand Dragons per week really makes very little difference to the plant at Swansea. I suppose Mettoy must make getting on for half a million *Corgi* toys every week. Besides, at the moment, assembly of the boards is being carried out by Race Electronics in Llantrisant.

"When we designed the Dragon we tried to make it well built and good value for money. We could have made the Dragon a 16K machine and done just as well with it — but that is not our philosophy. Ram is cheap if you design it in in the first place — and we are not into ripping people off. We tried to make it robust — and we gave it a good keyboard. That board costs ten times more than the one on the Spectrum — but it was worth it. I'm convinced that it is one of the reasons the Dragon sells.

"It was really designed with my own family in mind — I have three sons aged between 10 and 15. Their interests are in

graphics and in games On the Apple we had at home the graphics were difficult to get at. I decided the Dragon must have fast easily accessible graphics — so it has the *Draw Circle Line* and *Paint* commands And it has been designed to be well suited for games playing

A lot depends on production — our only constraint at the moment We are now turning down retail orders for Christmas and only taking 1983 orders Even so we will produce 30 000–35 000 machines this year

It was a very positive decision to sell the Dragon in high street shops At £200 the machine is a considered purchase There is only so much information you can get from an advertisement — and actually being able to try out the machine in the shop is very important You can't do that through mail-order

All the big chain stores are going through a transition period — they are learning that they cannot sell computers in the same way as a tv or hi fi The big multiples will I am sure end up with special micro display areas within the stores staffed with people who know what they are doing A computer is a specialist sale

"We see a great future for the Dragon It will continue as a product at least until 1985 with enhanced features It is big — and the inside can change an awful lot without needing to change the moulding

February or March next year should see a disc-operating system and discs The disc controller will operate any 40 tpi or 80 tpi 5¼in double- or single-sided disc drives We will be offering a 40 tpi drive The operating system and discs will be available together for around £250

"We have more or less finished design work on a multi tasking operating system for the machine — an OS9 system Using it the Dragon will be able to do more than one thing at a time The OS9 system can also support a whole range of compilers — Forth, Pascal, Cobol Unix and 09-structured Basic all of which will enhance the value of the machine to the serious micro user

"We will also do a special version for use in education — with built-in RGB monitor and cassette player — and a networking system is being developed

'There will be an expansion box early next year giving a 64K Dragon The expansion kit will include the OS9 system an editor/assembler and O9 Basic — all for less than £150

"The whole theme from Dragon is good quality and good value for money — and



we try very hard not to offer what we don't have We will be going for Roms on the disc-operating system in the next two or three weeks — and we will announce the launch to the public at the time we can manufacture it and not before

"As the machine grows software is going to become more and more important We have a range of small business software — using the disc system — planned for the Spring This will be followed by more games home utilities — again making use of the discs — and a range of educational software for schools

All of which explains Mettoy's decision to sell Dragon to a consortium in which it holds only an 18 61 percent share Such an ambitious development program requires considerable capital expenditure — expenditure which Mettoy at present can ill afford

The sale — giving Prutec (the Prudential Group's high-technology investment company) a 40 74 percent stake in Dragon Data — will raise £2 4m to fund the development programme Mettoy retains the option to buy back into the company to the tune of 35 percent in 1984–85 and will continue to manufacture and assemble the body of the Dragon micro

Dragon Data will manufacture between 150 000 and 200 000 machines next year of which at least half will be exported first to Europe and then the US and Japan The only problem is compatibility with the various tv systems We will have a SECAM version for France in a few weeks NTSC is easy and of course we already have a PAL version

"Dragon also has an entirely new machine, scheduled for the third quarter of 1983 It will complement the Dragon — not replace it — and is aimed at another very specific undeveloped area of the market It will not be 6809 but will run both 6809 and 68000 software

We may call it the Super Dragon — but we will sort out the name when we get a little closer to it!


Assembling and quality checking

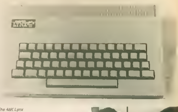
The Lynx: pause for thought

***Tim Langdell** presents the first review of the 48K Lynx from Camputers – a low cost micro that is equally at home in the house or the office*

At £225 the Lynx from Camputers of Cambridge promises to be one of the most exciting new micros to arrive on the scene this year. It offers 48K of Ram as standard, expandable almost without limit in 64K blocks, and 32K of video memory (leaving 16K of workspace) expandable to 64K for even higher resolution graphics. Its Basic is among the most advanced available, and its potential for future expansion is among the best there is.

The heart of the Lynx is a Z80A CPU as used in the Spectrum, ZX81, early Tandy machines and the Research Machines 380Z. The Z80A is probably the most advanced 8-bit CPU presently available (although lovers of the 6809 may argue differently). It has a well-structured machine language which makes the design of a sophisticated micro relatively easy compared with the less sophisticated 6502 chip (as used on the BBC machines for instance). However, using the Z80A with more advanced high-resolution colour micros can lead to problems with screen handling — but more of that later.

The Lynx comes with 48K of Ram and 16K of Rom. Of the 48K Ram, 32K is used as video Ram allowing a bit addressable high-resolution graphic display of 248 by 256. The eight available colours are bit addressable too. Thus the Lynx can put all

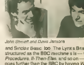


The 48K Lynx

eight colours in a single character square, unlike its nearest rivals the Spectrum or the Dragon 32. The text is 40 columns by 24 rows and is thus teletext compatible — again unlike the Dragon or the Spectrum.

The Ram can be extended indefinitely in banks of 64K, much as the NewBrain can be. Being Z80A based and capable of such Ram upgrade, the Lynx is able to run CPM TM, unlike all other micros in this price range. Although the video memory is standard at 32K, it can be upgraded to 64K by a very simple modification, giving 80-column text display instead of the regular 40-column version. The potential for the business market is clear. Moreover, a disc drive card which plugs inside the casing will become available soon. It has an RS232 interface as standard, and a parallel interface is an integral part of the disc card.

What Camputer's programming expert Davis Jansons has managed to cram into the 16K of Rom in the Lynx is quite incredible. He has created a new Basic with similarities to Microsoft, BBC Basic



John Shirreff and Davis Jansons

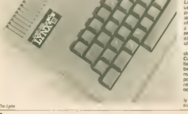
and Sinclair Basic too. The Lynx's Basic is structured as the BBC machine's is — with *Procedures*, *If-Then-Else*, and so on — but goes further than the BBC by having *While* and *Wend* too.

Davis has made the entry of machine code from Basic a superbly easy task for the more serious programmer. The keyword *Code* has been included to indicate that what follows are *Hex* bytes of machine code. The keyword *Call* then enables the user to call the machine code routine from Basic, and *Lctn* xxx allows the user to indicate that the machine code routine is in line number xxx. All of which adds up to an extremely useful tool.

The more usual Basic keywords are, of course, also there, with many enhancements. For instance, as well as offering *Goto* and *Gosub*, the Lynx offers *Goto Label* and *Gosub Label* which allows the user to give a subroutine or part of a program a label rather than refer to it by its starting line number. The Spectrum also effectively supports such a facility because it will allow numeric variables to have full names. However, the Lynx, while only allowing single character variables, does offer a more obviously structured Basic.

The attention given to making programs clear, easy to read and write, is laudable. Camputers has even made the Lynx's listings indented, with *For Next* loops being more indented than other statements, and so on. While this feature is possible on the BBC machines too, it is a relief not to have to type in additional commands to achieve this useful feature.

In brief then, the Lynx's Basic is superbly complete, offering many luxuries such as auto line numbering, deletion of line num-



The Lynx

bars direct entry to the monitor *(Mon)* renumber and even a keyword *Ext* which allows the user to add extra Basic keywords called from Ram or stored on Eproms or Roms

Davis Jansens has aimed to make Lynx Basic among the fastest around While no bench test type figures are available yet running many standard tests of speed on the Lynx puts it in a class alongside the BBC machines

However while the Lynx Basic's speed of execution is fast its screen handling is rather slow This seems to be due to the inherent problem of screen handling with a Z80A when high resolution colour and graphics are being supported When displaying to the screen the Lynx seems to be several orders of magnitude slower than machines using the 6502 (such as the BBC) or the 6809 (such as the Dragon) This is a great pity given that the availability of colour definition at the pixel level makes the writing of colourful games very tempting — without recourse to good machine code writing though fast-moving games on the Lynx may not be possible

This said there is no other micro for its price (except perhaps the recent MPF2 from Multitech) that allows true high resolution colour The Lynx also has many built-in graphics commands such as *Draw Move Plot*, *Paint Ink* and *Paper* (at least some of Sinclair Basic has caught on) The Lynx also offers a *Window* facility enabling the user to define a text window within the normal screen area — much as the BBC machines do

Autorun

As with the ZX Spectrum programs can be *Saved* to tape followed by both a name and *Line* which causes the program to autorun upon *Loading* Unlike the Spectrum, though the Lynx makes it easy to have *Appended* (ie *Merged*) programs autorun too

Other non-standard features also are rather nice For instance, the Lynx has an immediate calculator mode where you simply type in the numbers eg 4*65 no keywords such as *Print* being necessary

Whereas you would normally type in a program in full on the Lynx as with most machines, it is also possible to have Spectrum-like single-key entry of just about every command Simply press the *Escape* key along with any of the main keyboard keys This feature is excellent and once again shows the great deal of thought that has gone into the Lynx

The keyboard also deserves a mention as does its general appearance The keyboard is among the best I have used on a micro — standing alongside the BBC machine as my favourite for touch typing The quality seems up to the standard of many word processors at least The casing of the Lynx is both functional and elegant — the sort of design which would be equally suited to the home as to the office

The room for expansion of this machine is very good indeed A 5¼in disc drive should be available soon and a 40-way bus at the rear of the machine brings out most of the connections necessary for hardware additions The Lynx comes standard with rgb+sync composite video and pal outputs all available from sockets at the back



Lynx computer and printer

In conclusion Lynx seems to have struck a very good middle ground in trying to please the serious user the first time buyer of a home computer and the small business user In many ways the Lynx must rival micros costing at least twice as much (such as the BBC model B and new SuperBrain) in the business sector, as well as offering extremely strong competition to micros in the £175 to £225 region such as the Dragon 32, the Vic and the 48K Spectrum

The Lynx is perhaps less well equipped than some others in the market for games playing (the screen handling is slow, and there is no ready provision for joysticks or plug-in Roms) but it does offer a full eight colours in true high resolution which no other similar-priced micro can offer

All in all the Lynx is excellent value at £225 for the standard 48K version

Computers' Lynx



Taking a closer look at the Lynx

Sinclair ZX Spectr

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!





First there was the world-beating Sinclair ZX80 The first personal computer for under £100

Then the ZX81 With up to 16K RAM available and the ZX Printer Giving more power and more flexibility Together, they ve sold over 500 000 so far to make Sinclair world leaders in personal computing And the ZX81 remains the ideal low-cost introduction to computing

Now there s the ZX Spectrum! With up to 48K of RAM A full-size moving-key keyboard Vivid colour and sound High-resolution graphics And a low price that's unrivalled

Professional power–personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81 But its new 16K BASIC ROM dramatically increases your computing power

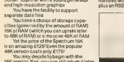
You have access to a range of 8 colours for foreground background and border together with a sound generator and high-resolution graphics

You have the facility to support separate data files

You have a choice of storage capacities (governed by the amount of RAM) 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version If so you can still return it later for an upgrade The cost? Around £60

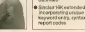


Ready to use today, easy to expend tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white)

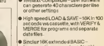
Employing Sinclar BASIC (now used in over 500 000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming Whether you re a beginner or a competent programmer you ll find them both of immense help Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional level computing

There s no need to stop there The ZX Printer – available now – is fully compatible with the ZX Spectrum And later this year there will be Microdrives for massive amounts of extra on line storage plus an RS232 / network interface board



Key featurea of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground background and border plus flashing and brightness-intensity control
- Sound – BEEP command with variable pitch and duration
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key
- High-resolution – 256 dots horizontally x 192 vertically each individually addressable for true high resolution graphics
- ASCII character set – with upper- and lower-case characters
- Teletext-compatible – user software can generate 40 characters per line or other settings
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes



um

ZX Spectrum software on cassettes – available now

The first 21 software cassettes are now available directly from Sinclair Produced by ICL and Psion, subjects include games education and business/household management Galactic Invasion Flight Simulation Chess History Inventions VU-CALC VU-3D ...47 programs in all There's something for everyone and they all make full use of the Spectrum's colour, sound and graphics capabilities You'll receive a detailed catalogue with your Spectrum

RS232/network interface board

This interface available later this year will enable you to connect your ZX Spectrum to a whole host of printers terminals and other computers

The potential is enormous And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM

sinclair

Sinclair Research Ltd, Stanhope Road, Camberley Surrey GU15 3PS
Tel Camberley (0276) 685311

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high resolution graphics

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions Printing speed is 50 characters per second with 32 characters per line and 9 lines per vertical inch

The ZX Printer connects to the rear of your ZX Spectrum A roll of paper (65ft long and 4in wide) is supplied along with full instructions Further supplies of paper are available in packs of five rolls



The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy

The transfer rate is 16K bytes per second with average access time of 3 5 seconds And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum

All the BASIC commands required for the Microdrives are included on the Spectrum

A remarkable breakthrough at a remarkable price The Microdrives are available later this year for around £50





How to order your ZX Spectrum

BY PHONE – Access Barclaycard or Trustcard holders can call 01 200 0200 for personal attention 24 hours a day every day BY FREEPOST – use the no-stamp needed coupon below You can pay by cheque, postal order, Access, Barclaycard or Trustcard

EITHER WAY – please allow up to 28 days for delivery And there's a 14 day money-back option, of course We want you to be satisfied beyond doubt – and we have no doubt that you will be

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125 00	
	Sinclair ZX Spectrum – 48K RAM version	101	175 00	
	Sinclair ZX Printer	27	59 95	
	Printer paper (pack of 5 rolls)	16	11 95	
	Postage and packing orders under £100	28	2 95	
	orders over £100	29	4 95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £ ______

*Please charge to my Access/Barclaycard/Trustcard account no

*Please delete/complete as applicable

Signature

PLEASE PRINT

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FREEPOST – no stamp needed **Prices apply to UK only** **Export prices on application**

Open Forum

Open Forum is for you to publish your programs and ideas
It is important that your programs are bug free before you send them in. We cannot test all of them
Contributions should be sent to: Popular Computing Weekly, *Hobhouse Court,*
19 Whitcomb Street, London WC2H 7HF

How to contribute

Each week the editor goes through all the programs that you send to Open Forum in order to find the Program of the Week.

The author of that program will qualify for DOUBLE the usual fee we pay for published programs

(The usual fee is £6.)

Presentation hints

Programs which are most likely to be considered for the Program of the Week will be computer printed and accompanied by a cassette.

The program will be well documented, the documentation being typed with double spacing between each line.

The documentation should start with a general description of the program and then give some detail of how the program has been constructed and of its special features.

Listings taken from a ZX Printer should be cut into convenient lengths and carefully stuck down on to white paper, avoiding any creasing.

Please enclose a stamped, self-addressed envelope.

Panic

on ZX81

On a distant planet in a far galaxy lives a gardener. He was once very happy until one day as he was gardening he saw two green eyes peeping over his hedge. As he walked around a small alien pest followed him, so he grabbed his spade in order to kill it. He swung his spade at it and it vanished. But who was to know that his garden was ridden with another four of these pests.

In this game for the ZX81 you are the gardener armed with a spade. You must beat the alien garden pests without them or you bumping into each other. Unfortunately life is not as simple as that because every time you kill an alien it leaves an uncrossable hole that must be avoided.

Once you clear one sheet of them another sheet appears, but after each sheet there are more holes which make you have to take diversions and are more difficult to avoid. For each alien killed you are awarded ten points. You are represented as **A** and the alien pests are represented as letter **Ms** which wander along the garden hedges. The controls are 5 Left, 8 Right, 6 Down, 7 Up, 0 Spade.

The variables are:
A/B Position of gardener
D/E Alien positions
S Score
C$, D$, E$, F$, G$ Aliens

```
   1 REM         ZX-PANIC
   2 REM     BY SIMON COX (C) 82
  10 LET S=0
 100 CLS
 101 PRINT [illegible]
 110 PRINT
 120 PRINT
 130 PRINT
 140 PRINT [illegible]
 [illegible]
 210 PRINT [illegible]
 220 PRINT
 230 PRINT
 240 PRINT
 250 PRINT [illegible]
 270 PRINT "M          M"
 280 PRINT
 290 PRINT "M          M"
 300 PRINT [illegible]
 310 PRINT
 320 PRINT
 330 PRINT [illegible]
 340 PRINT "[illegible] Z X P A N"
 350 PRINT [illegible]
 370 LET A=3
 380 LET B=1
 390 LET C=1
 400 LET D=[illegible]
 401 LET E=0
 410 LET C$="M"
 420 LET D$="M"
 430 LET E$="M"
 440 LET F$="M"
 450 LET G$="M"
 500 PRINT AT 3,E;D$;AT 7,E+14;E$;AT 11,E+7;F$;AT 15,E;G$;AT 15,E+14;G$
 510 LET E=E+D
 540 PRINT AT A,B;
 541 LET A$=CHR$ PEEK (PEEK 16398+256*PEEK 16399)
 552 PRINT AT A+1,B;
 553 LET Z$=CHR$ PEEK (PEEK 16398+256*PEEK 16399)
 560 PRINT AT A,B;" "
 561 IF I$=" " THEN GOTO 1000
 562 IF A$="M" THEN GOTO 1000
 563 IF E=12 THEN LET D=-1
 564 IF E=3 THEN LET D=1
 565 PRINT AT A,B;A$
 570 LET B=B+(INKEY$="8" AND B<31)-(INKEY$="5" AND B>0)
 580 LET A=A+(INKEY$="6" AND Z$="M")-(INKEY$="7" AND A$="M")
 590 IF INKEY$<>"0" THEN GOTO 500
 591 PRINT AT A,B+1;
 592 LET Y$=CHR$ PEEK (PEEK 16398+256*PEEK 16399)
 593 PRINT AT A,B-1;
 594 LET V$=CHR$ PEEK (PEEK 16398+256*PEEK 16399)
 600 FOR N=1 TO 5
 610 PRINT AT A,B;"A";AT A,B+1;"[illegible]";AT A,B+1;"[illegible]";AT A,B
 620 NEXT N
 621 FOR N=1 TO 5
 622 PRINT AT A,B;"A";AT A,B-1;"[illegible]";AT A,B-1;"[illegible]";AT A,B
 623 NEXT N
 800 IF A=3 AND B+1=E OR A=3 AND B-1=E THEN LET D$=" "
 801 IF A=7 AND B+1=E+14 OR A=7 AND B-1=E+14 THEN LET E$=" "
 802 IF A=11 AND B+1=E+7 OR A=11 AND B-1=E+7 THEN LET F$=" "
 804 IF A=15 AND B+1=E OR A=15 AND B-1=E THEN LET C$=" "
 805 IF A=15 AND B+1=E+14 OR A=15 AND B-1=E+14 THEN LET G$=" "
 806 IF A=3 AND B+1=E THEN PRINT AT A+1,B+1;"M";AT A+1,B+1
 807 IF A=3 AND B-1=E THEN PRINT AT A+1,B-1;"M";AT A+1,B-1
 808 IF A=7 AND B+1=E+14 THEN PRINT AT A+1,B+1;"M";AT A+1,B+1
 809 IF A=7 AND B-1=E+14 THEN PRINT AT A+1,B-1;"M";AT A+1,B-1
 810 IF A=11 AND B+1=E+7 THEN PRINT AT A+1,B+1;"M";AT A+1,B+1
 820 IF A=11 AND B-1=E+7 THEN PRINT AT A+1,B-1;"M";AT A+1,B-1
 830 IF A=15 AND B+1=E THEN PRINT AT A+1,B+1;"M";AT A+1,B+1
 840 IF A=15 AND B-1=E THEN PRINT AT A+1,B-1;"M";AT A+1,B-1
 841 PRINT AT 3,E;D$;AT 7,E+14,E$;AT 11,E+7;F$;AT 15,E;C$;AT 15,E+14;G$
 842 IF V$="M" OR Y$="M" THEN LET S=S+10
 895 PRINT AT 0,15;S
 896 IF C$=" " AND D$=" " AND E$=" " AND F$=" " AND G$=" " THEN GOTO 1065
 900 GOTO 500
1010 PRINT AT A,B;"[illegible]";AT A,B;"[illegible]"
1030 PRINT AT 10,12;"GAME OVER";AT 21,3;"PRESS ANY KEY"
1040 IF INKEY$="" THEN GOTO 1010
1050 CLS
1060 RUN
1065 PRINT AT A,B;" "
1070 LET A=3
1080 LET B=1
2000 GOTO 410
```

Panic
by Simon Cox

Turn to page 21

How to make the best home computer in the world even better.

Peripherals to turn a powerful computer into a super-computer for the professional.

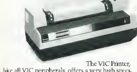
With VIC, you have the finest home computer money can buy. And the more you use it, the more you will ask it to do.

Pretty soon, you'll want to extend VIC's vast potential to the full, and there is a wide range of VIC peripherals to help you do it.

Disk drives, disk-based software, a printer, cassette unit, joysticks, paddles – with these, VIC computing becomes total computing, giving you true professional power and capability.

We describe the major units here.

VIC PRINTER



The VIC Printer, like all VIC peripherals, offers a very high specification at a very competitive price.

It will print programs, letters, business data, graphic displays and so on.

Its main features include: 80 characters per line • Tractor feed dot matrix • 30 characters per second print speed • Full alphanumerics and graphic printing • Double-size character capability • All cables and leads.

VIC FLOPPY DISK UNIT

The VIC single-drive Disk Unit provides a fast, accurate and efficient means of storing and retrieving data and programs.

Together with the Printer, it transforms the VIC 20 into the ideal system for the small businessman or serious computer programmer.

Features include: 174,848 bytes capacity • Uses soft-sectored standard 5¼" single density floppy disks • Direct interface to VIC • Direct compatibility with Printer • Intelligent system independent of VIC. (VIC RAM not required to run it.)

EXPANSION MEMORY CARTRIDGES

Special plug-in cartridges are available to expand VIC's memory 3K, 8K and 16K RAM packs plug directly into the computer.

A Memory Expansion Board is also available to develop VIC's capabilities to the maximum.

For full details of VIC 20, its peripherals and software, and a list of your local dealers, contact: The Commodore Information Centre, 675 Ajax Avenue, Slough, Berkshire, SL1 4BG. Tel: Slough (0753) 79292.

commodore

VIC 20

The best home computer in the world.

Let Commodore expand your horizons.

VIC 20 is the finest home computer that money can buy.

And the better you get to know it, the more confident, adventurous and ambitious you'll become.

You'll want to take advantage of the vast range of VIC software: a superb and constantly-growing selection of programs, embracing business systems, entertainment, education and many applications in the home.

Every program in the series has been designed by experts, and chosen for its quality and value for money.

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A mind-blowing range of games including Scott Adams' world-famous 'Adventure' series.

Advanced space games, including the sophisticated 'Omega Race'.

Learn subjects as diverse as English Language, programming, and biology.

And 'home' software ranges from IQ tests to Robert Carrier menus.

In addition, there is a range of VIC software, like programmers' aids and graphics packages – to add to your understanding and enjoyment of computers and computing.

There's even a special 'VicSoft' Club for VIC 20 enthusiasts, with many advantages including special offers to club members.


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VIC software will expand your horizons. And your mind.
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VCPCY 11/82



'Whether your interests lie in business, educational, scientific, control or games applications, this system provides a possibility for expansion which is unparalleled in any other machine available at present,' comments Paul Beverley in the July 1982 edition of *Personal Computer World*.

The BBC Microcomputer can genuinely claim to satisfy the needs of novice and expert alike. It is a fast, powerful system generating high resolution colour graphics and which can synthesise music and speech. The keyboard uses a conventional layout and electric typewriter 'feel'.

You can connect directly* to cassette recorder, domestic television, video monitor, disc drives, printers (dot matrix and daisy wheel) and paddles. Interfaces include RS423 (inter-operable with RS232C equipment) and Centronics. There is an 8-bit user port and 1MHz buffered extension bus for a direct link to Prestel and Teletext adaptors and many other expansion units. The Econet system allows numerous machines to share the use of expensive disc drives and printers.

BASIC is used, but plug in ROM options will allow instant access to other high level languages (including Pascal, FORTH and LISP) and to word processing software.

A feature of the BBC Microcomputer which has attracted widespread interest is the Tube, a design registered by Acorn Computers. The Tube is unique to the BBC Microcomputer and greatly enhances the expandability of the system by providing via a high speed data channel for the addition of a second processor. A 3MHz 6502 with 64K of RAM will double processing speed, a Z80 extension will make it fully CP/M** compatible.

The BBC Microcomputer is also at the heart of a massive computer education programme. The government has recommended it for use in both primary and secondary schools. The BBC Computer Literacy Project includes two series of television programmes on the use and applications of computers.

There are two versions of the computer. Model A, at £299, offers 16K of RAM and Model B at £399 has 32K of RAM.

For technical specification and order form send stamped addressed envelope to PO Box 7, London W3 6XJ and for details of your nearest stockist ring 01-200 0200.

Broader horizons

BBC Model B Microcomputers are available for immediate despatch by courier to your door.

If you would like to take advantage of our special delivery offer just fill in this coupon, but remember this only applies to the Model B, and only in the UK. Any other items have to be ordered on the standard order form or from a BBC Computer Stockist.

BBC Microcomputer System Offer
c/o Vector Marketing
Dennington Estate
Wellingborough
Northamptonshire NN8 2RL

Please send me by courier 1 BBC Model B Microcomputer(s) at £399 including VAT and delivery.

Cheque enclosed for £ 399 payable to BBC Microcomputer System readers a/c our charge
ACCESS / BARCLAYCARD

Signed Simon Bray
Name SIMON BRAY
Address 40 ROCK ROAD
CAMBRIDGE
Postal Code CB1 4UF

Co Reg No [illegible] VAT No [illegible]

The BBC Microcomputer System

BBC Microcomputer System Offer, c/o Vector Marketing, Dennington Estate, Wellingborough, Northamptonshire NN8 2RL.

*Model A has a limited range of interfaces but can be upgraded to meet Model B specification.
**CP/M is a registered trade mark of Digital Research.
The BBC Microcomputer is designed, produced and distributed in the UK by Acorn Computers Limited.

from page 16

City Bomber

on Vic20

The object of City Bomber is to land on the city — but before you can land you must destroy the buildings. This version has only one control — Fire (controllable by any key). Only one bomb may be falling at any time.

There are nine skill levels (1-9). One is the hardest, nine the easiest. These are selected at the beginning of the game. When a city is destroyed you are given a bonus and start on a new city, but on a slightly higher level.

Program notes

Lines 0 to 50 — set up buildings and jump to instructions etc at 500
Lines 80 to 150 — main game
Lines 200 to 300 — ending routine
Lines 350 to 400 — landing routine
Lines 500 to 600 — instructions
Lines 1000 to 1035 — Hi-res routine
Lines 1040 to 1202 — data for Hi-res

```
0 DIML 1 B H C
1 GOSUB500
2 POKE36878 15
3 DEFFNA(X)=PEEK(828)+256*PEEK(829)
4 DEFFNB(X)=INT(X/256)
6 FORF=22TO0STEP-1 POKE36866 (F)OR128 POKE36867,F*2OR128
POKE36876,F*2+128
7 POKE36864,(22-F)+12 POKE36865 (22-F)+38 FORL=0TO10 NEXT
L F
10 PRINT"" POKE36879 11 POKE36869 255
15 FORF=0TO22 POKE36866 (F)OR128 POKE36867 F*2OR128
POKE36876 F*2+128
16 POKE36864 (22-F)+12 POKE36865 (22-F)+38 FORL=0TO10
NEXT L,F
17 POKE36867 46+128 POKE36876 0
18 FORF=22*22TO22*22+21 POKEF+7680 47 NEXT
19 LE=INT(LE/1 5)+1
20 FORA=0TO21
25 RH=INT(RND(1)*10)+5+LE RC=INT(RND(1)*7)+1
26 IFRH=21THENRH=20
30 FORB=21TORHSTEP-1
35 IFB=RHTHENPOKEA+B*22+7680 40 POKEA+B*22+38400 RC GOTO50
40 POKEA+B*22+7680 39 POKEA+B*22+38400 RC
45 POKE36876 A*4+128
50 NEXTB A POKE36876 0
60 B=0 L=0 H=2 C=36876
70 POKE781 H POKE782 L SYS65520 PRINT " "
75 L=L+1 IFPEEK(L+H*22+7681)=40THENPOKEL 32 POKE38720+L 1
GOTO200
76 IFINT L/22)*22=LTHENH=H+1 L=0
80 POKE782 L POKE781 H SYS65520 PRINT")*"
90 X=PEEK(197)
95 PRINT SCORE S TAB(11)"HIGH" FNA(1)
110 IFX=22ANDB=0THENB=L+22*H+22+7680
115 IFB=0THENFORF=0TO20 NEXT GOTO141
120 POKEB 2 POKE38720+B 1 B=B+22
121 IFPEEK(B)=39ORPEEK(B)=40THENS=S+10
122 POKEB 43
123 IFC=0THENC=230
124 POKE36876,C
125 C=C-1 IFC<128THENC=0 POKE36876,0
130 V=7
140 IFB>8141THENPOKEB 32 B=0 C=0 POKEB 0
14 V=7
145 IFL+22*H=469THEN350
150 GOTO70
200 POKEG 0 POKEG+3,0 FORF=15TO0STEP-1 POKEG+1 220
POKEG+2 F FORT=0TO100 NEXTT F
210 POKE36877 0 POKE36878 0 POKE36869 240 PRINT"" TAB(5)
"CRASHED "
220 PRINTTAB(5)"————————"
230 PRINT SCORE=";S
240 IFS>FNA(1)THENPRINT" NEW HIGH SCORE!" B=FNB(S)
POKE829 B POKE828 S-B*256 GOTO260
250 PRINT"HIGH SCORE=" FNA(1)
260 PRINT "ANOTHER GO?
270 GETX$ IFX$=""THEN270
280 IFX$<>"Y"ANDX$<>"N"THEN270
285 POKE36878 27 PRINT""
286 POKE36867 28+46 POKE650,0
290 IFX$="Y"THENRUN
300 END
350 FORL=1TO7
355 PRINT "BONUS 100 POINTS"
360 FORX=250TO 20+LA POKE36876 X FORT=1TO25 NEXTT X
370 PRINT ""
380 FORE=1T  T
390 NE T
400 S=S+100 GOTO
```

```
500 PRINT "TAB(5) "CITY BOMBER"
510 PRINT" I HEGERTY"
550 PRINT"LAND THE SHIP ON THE CITY YOU MUST DESTROY THE
SKYSCRAPERS USING SPACE "
555 PRINT"TO DROP A BOMB.
560 PRINT"EACH LEVEL OF A        BUILDING IS WORTH
10 POINTS
570 PRINT IF YOU CRASH YOUR GO  IS OVER
571 PRINT"LEVEL 9 IS THE EASIEST1 IS THE HARDEST
580 GOSUB 
581 PRINT SELECT LEVEL(1-9 
582 POKE   LE=VAL(CHR$(PEEK(  ))) IFLE<1ORLE>9THEN582
583 PRINT LE
590 PRINT "PRESS ANY KEY"
600 WAIT   KE  RN
999 END
1000 POKE56 28 POKE55 0
1005 IFPEEK(7300)=64THEN1020
1010 FORF=7168TO7680 POKEF,PEEK(25600+F) NEXT
1012 FORF=7424TO7431 POKEF 0 NEXT
1015 POKE828 0 POKE829 0
1020 FORF=7400TO7407+6*8
1030 READXX POKEF XX NEXT
1031 IFPEEK(0)=76THENPOKE0 0
1034 PRINTCHR$(142  CHR$(8)
1035 RETURN
1040 DATA127 127 73 73 73 73 127 127
1050 DATA0 0 0 28,62 62 127 127
1055 DATA128 128,255 255,159 255 17 55
1060 DATA0 0 240 200 232 252 0 128
1070 DATA0 56 16 16 56 56 56 16
1090 DATA17 19 19 255 255 19 19 17
1100 DATA60 66 157 147 145 157 66 60
1110 DATA0 0 0 0 0,0 16
1111 DATA120 85,170 85 170 85 170,85
1202 DATA140,40,0 5 140 40 0,5 150 40 0 1
```

City Bomber
by Ian Hegarty

Draw

on BBC Micro

This program will run on the BBC model A or B. It can be used to experiment with drawing rectangles, polygons, circles or cones. Shapes drawn can easily be erased, redrawn, translated or scaled.

Program notes

Lines	
30	Selects a red background and yellow foreground
50	Sets up a two line text window at the top of the screen
60	Selects centre of shape, eg 640 512 is the middle of the screen
70	Radii 1A — B shape is symmetrical, eg 100 100
80	Number of sides to shape. With sides > 30 the closer shape becomes a circle
90 to 100	Option to connect up corners of shape to a given point thereby producing a cone effect
130 to 190	*Input* statement. Translate (T) moves object centre point to new position and redraws. Scale (S) multiplying factor increases or decreases overall size of object. *Clg* (C) can be used to clear entire graphics area and start again
160	*Input* values used to translate shape. *Input* string used to enable erase to work (if required) before using *Val* function to convert string to number
200	*Input* multiplying factors to produce scaling. String used again as in line 180
380 to 430	*Procedure* used to draw required shape
440 to 480	*Procedure* used to erase last shape in response to input E

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```
 10 CLS :MODE4
 20 VDU 19,0,1,0,0,0,19,1,3,0,0,0
 30 LET H=0:LETV=0:LET S1=1 LET S2=1
 50 VDU 20,0,1,39,0
 60 INPUT"CENTRE X Y "HS,VS
 70 INPUT "RADII A,B "A,B
 80 INPUT"NUMBER OF SIDES "N
 90 INPUT'CONE GEN(Y/N) 'ZC$ IF ZC$='N'THEN 110
100 INPUT'POINT OF CONE X,Y " PX,PY
110 ANGLE=2*PI/N
120 CLS  PROCdraw
130 INPUT"(T)ranslate (S)cale or (C)LG...''A$
140 IF A$='T" GOTO 180
150 IF A$="S" GOTO 240
160 IF A$='C' CLG
170 GOTO 30
180 INPUT'HORIZ SHIFT, VERT SHIFT   H$ V$
190 INPUT'(E)rase or <CR>...' ' A$
200 IF A$="E' PROCdelete
210 LET H=VAL(H$) LET V=VAL(V$)
220 PROCdraw
230 GOTO 130
240 INPUT HORIZ STRETCH, VERT STRETCH 'S1$,S2$
250 INPUT'(E)rase or <CR>...? ' A$
260 IF A$='E' PROCdelete
270 LET S1=VAL(S1$) LET S2=VAL(S2$)
280 PROCdraw
290 GOTO 130
300 DEF PROCdraw
310 C=COS(ANGLE) S=SIN(ANGLE)
320 XA=1 YA=1
330 FOR I=1 TO N+1
340 X=XA*C-YA*S Y=XA*S+YA*C
360 XA=X YA=Y
370 IF I>1 THEN 380 ELSE 390
380 DRAW ((A*S1)*XA+HS)+H,((B*S2)*YA+VS)+V
390 MOVE ((A*S1)*XA+HS)+H,((B*S2)*YA+VS+V)
400 IF ZC$='N  THEN 420
410 MOVE PX,PY:DRAW((A*S1)*XA+HS)+H,((B*S2)*YA+VS)+V
420 NEXT I
430 ENDPROC
440 DEF PROCdelete
450 GCOL 0,0
460 PROCdraw
470 GCOL 0,1
480 ENDPROC
```

Draw
by Barry Wells

Data Statement Builder

on Spectrum

The construction of Basic *Data* statements can be a very tedious task especially when there is a lot of mixed (numeric and alphabetic) data in the line. This might often be the case when very complex displays are being *Drawn* or *Plotted*. This program was designed to make the construction of a complex *Data* statement a little less tedious. It relieves the user of the need to remember the intervalue commas and the quotes round alphanumeric data.

The data to be stored is housed in a *Rem* statement which the program converts to a *Data* line at the finish of the program. The user only needs to edit the line to remove surplus bytes at the statement's end — and your *Data* statement is ready for the rest of your program. The length of line 1 must be equal at least to the amount of data you want to store.

Lines 550 and 560 check for the presence of the *Rem* and the amount in it if present. Lines 2 to 8 determine the start of the *Basic* program, the address of the first byte after *Rem* and the amount of space in it.

Data is entered in two forms — A Test for alphabetical data (strings), and N 12 45 for numeric data. The presence of illegal characters in numeric data is checked in lines 60 to 75. Line 85 determines the length of the whole string to be poked into the *Rem*, viz the enclosing quotes for string variables plus the comma following the value.

Subroutine 500 is the routine that checks the type of data present. Only N or A prefixed data is allowed. Lines 105 to 130 *Poke* the data into the *Rem* with enclosing quotes if needed, and follow with a comma. The data just entered is printed on screen at line 140 and the available bytes up-dated and checked in subroutine 560. Accepted data is signalled by a high *Beep*, rejected data or an error condition by a low *Beep*.

It would be possible to shorten line 1 after all data is entered, though it was felt that the need to edit out the trailing bytes was a useful point at which to visually inspect the line. Note that the *Rem* must be in line 1, though it could be anywhere if its address is known.

Note that in line 42 *Stop* is the token Stop. In line 560 (@" AND amount less than sign 10) will print a leading @ when the byte count gets below 10. @ = space. Several possible uses could be made of this technique, viz building *Plot* and *Draw* data lines and large amounts of string data for screen printing.

```
   1 REM [illegible]
   2 LET l=PEEK 23635+256*PEEK 2
3636  LET end=PEEK (l+2)+256*PEE
K (l+3)
   6 LET start=l+5  LET inst=st
art-1
   8 LET amnt=end-5
  15 BRIGHT 1  CLS  LET z=
  20 PRINT "[illegible] DATA buil
er program"  © Sept 1984 by P
L Newman [illegible]
  25 PRINT "This program allows
entry of numeric,alphabetic o
r mixed data which is built in
to a DATA line,"
  30 PRINT "Data is entered [illegible]
s this -- " Nfor numeric [illegible]
numeric  Afor alpha -- for al
phabetic
  35 BEEP .5,30 PRINT "Use sym
-shift A to finish  GO SUB 550
  40 INPUT FLASH 1, Data value ?
"; LINE a$  IF a$="" THEN GO TO
40
  42 IF a$=" STOP " THEN GO TO 8
10
  45 GO SUB 500  IF t<>-1 AND LE
N a$>1 THEN GO TO 85
  50 BEEP .8,10  GO TO 40
  55 IF t=1 THEN GO TO 85
  60 FOR j=2 TO LEN a$
  65 IF a$(j)=" " THEN [illegible]
  70 IF a$(j)<"0" OR a$(j)>"9" T
HEN GO TO 80
  75 NEXT j  GO TO 85
  80 PRINT AT 21,0,z$;AT 21,0; F
LASH 1, Error in numeric data
PAUSE 100  PRINT AT 21,0; FLASH
0,z$  GO TO 40
  85 LET l=LEN a$-1+1+a$(1=1)
  90 IF LEN a$-2+1+a$(1=1)>amnt
THEN GO TO 570
  95 BEEP .2,30
 100 IF t=0 THEN GO TO 110
 105 POKE start,34  LET start=st
art+1
 110 FOR j=1 TO l-1-2*(t=1)
 115 POKE start,CODE a$(j+1)
 120 LET start=start+1  NEXT j
 125 IF t=1 THEN POKE start,34
LET start=start+1
 130 POKE start,44  LET start=st
art+1
 135 LET amnt=amnt-l  GO SUB 560
 140 PRINT AT 20,0,z$ z$ AT 20,0
;"last data= ",a$(2 TO )
 145 GO TO 40
 500 LET t=0
 510 IF a$(1)="A" OR a$(1)="a" T
HEN LET t=1  RETURN
```

To next page

```
 520 IF a$(1)="N" OR a$(1)="n" T
HEN LET t=0: RETURN
 530 RETURN
 550 IF PEEK (l+4)<>234 THEN PRI
NT AT 8,8; FLASH 1;"No REM prese
nt": GO TO 580
 560 PRINT AT 8,4;"      AND (amt(
10) amt;" bytes,incl.punctuatio
n"
 565 IF amt>1 THEN GO TO 580
 570 PRINT AT 8,4; FLASH 1;"No /
 - extend line 1 " GO TO
580
 590 RETURN
 600 BEEP 1,-10: STOP
 610 POKE instr,200
 620 CLS : PRINT AT 10,0;"''''
''''''''''''''''''''''''''''   "Yo
u must now edit line 1 to "elim
inate trailing data/commas" ''
''''''''''''''''''''''''''''''
 630 PAUSE 200: CLS : LIST
 700 SAVE "databuild" LINE 5
```

```
################################

      DATA builder program
   © Sept 1982 by P L Newman

     7 bytes,incl.punctuation
################################
```

```
This program allows entry of
numeric,alphabetic or mixed data
which is built into a DATA line.

Data is entered like this --

Ntor n]12.3 -- for numeric
Ntor alabcd -- for alphabetic

Use sym shift A to finish

last data= 12.00
```

Data Statement Builder
by Paul Newman

Grandprix

on Dragon

This game for the Dragon 32 computer is called Grandprix and uses full colour hi-resolution graphics and sound. The program simulates a day at the races: you start with £500 and must bet on which car will win; there are four races to each game.

After placing your bet the lights will go red, yellow, green and away they go. Your car will be shown in yellow. As well as being a fun game this program demonstrates many of the Dragon's advanced graphic capabilities and if studied it should help clarify some of the short-comings of the manual.

When the cars are actually racing the cassette player is switched on and any tape in it will be played through the tv speaker. I use a tape of real racing cars which is very effective with the graphics but music could be just as good.

Program notes

Lines	
10 to 70	Define the racing cars and place them into the two arrays A & B. A is a blue car & a yellow one (player's car)
80 to 210	Initialise and place bets, check if run out of money
220 to 390	Draw the track, put the cars at the start, draw the traffic lights and work them and turns on cassette player
400 to 480	Race the cars
490 to 550	Results and messages also add winnings if necessary

```
 10 PMODE3,1:COLOR3,1:PCLS
 20 A$="BM4,0R9D3L9NU3R4D4R1U3D4L5R26D7L26U7R20U5L2U1R5D1L2D48D8D6R2D1L5
U1R2U5L15D5R4D3L9U3R4U5BU2BR4R9U3L9D3"
 30 DRAW"C3XA$;"
 40 PAINT(7,2),3,3:PAINT(7,21),3,3:PAINT(6,12),3,3:PAINT(15,12),4,3
 50 DIM A(35,25):GET(0,0)-(35,25),A,G
 60 PCLS:DRAW"C2XA$;":PAINT(15,12),4,2:PAINT(7,2),2,2:PAINT(7,21),2,2:PA
INT(7,12),2,2:DIM B(35,25):GET(0,0)-(35,25),B,G
 70 PCLS
 80 Y(1)=10:Y(2)=60:Y(3)=110:Y(4)=160:RA=0:PT=500
 90 PCLS:'PLACE BETS
100 IF PT<=0 THEN 540
110 CLS
120 PRINT "RACE NUMBER"RA+1:PRINT
130 PRINT "YOU HAVE $"PT:SOUND 190,1
140 PRINT:SOUND190,1:INPUT "HOW MUCH DO YOU BET";PB
150 IF PB>PT OR PB<=0 THEN 90
160 PT=PT-PB
170 SOUND 190,1:PRINT
180 INPUT "WHICH CAR DO YOU BET ON (1-4)";PC
190 IF PC=1 OR PC=2 OR PC=3 OR PC=4 THEN 200 ELSE 170
200 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT"           STAND BY":PRINT:
PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
210 SCREEN 0,1:PLAY"T30V20O2AEDCAEDCAEDCAEDC":FORDD=1TO1000:NEXTDD
220 'START RACE
230 SCREEN 1,0
240 X(1)=0:X(2)=0:X(3)=0:X(4)=0
250 FOR I=1 TO 4:PUT(X(I),Y(I))-(X(I)+35,Y(I)+25),A,PSET:NEXTI
260 COLOR 4,1:LINE(0,3)-(238,3),PSET:LINE(0,47)-(238,47),PSET:LINE(0,97)
-(238,97),PSET:LINE(0,147)-(238,147),PSET:LINE(0,192)-(238,192),PSET
270 FOR Y=3 TO 192 STEP8
280 LINE(242,Y)-(245,Y+3),PSET,BF:LINE(246,Y+4)-(249,Y+7),PSET,BF:NEXTY
290 COLOR3,1:LINE(100,55)-(120,90),PSET,BF
300 COLOR 4,1:LINE(106,58)-(115,63),PSET,BF:SOUND190,1:TIMER=0
310 IF TIMER<100 THEN 310
320 COLOR3,1:LINE(106,58)-(115,63),PSET,BF
330 COLOR2,1:LINE(106,68)-(115,73),PSET,BF:SOUND190,1:TIMER=0
340 IF TIMER<100 THEN 340
350 COLOR3,1:LINE(106,68)-(115,73),PSET,BF
360 COLOR1,1:LINE(106,78)-(115,83),PSET,BF:SOUND190,1:TIMER=0
370 IF TIMER<60 THEN 370
380 MOTOR ON:AUDIO ON
390 COLOR1,1:LINE(100,55)-(120,90),PSET,BF:COLOR3,1
400 C=RND(4)
410 FOR A=1 TO 4
```

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```
420 X=X(C):X(C)=X(C)+RND(15)*2
430 FOR M=X+2 TO X(C) STEP 4
440 IF C=PC THEN PUT(M,Y(C))-(M+35,Y(C)+25),B,PSET ELSE PUT(M,Y(C))-(M+3
5,Y(C)+25),A,PSET
450 IF M>210 THEN 495
460 NEXT M
470 C=C+1:IF C=5 THEN C=1
480 NEXT A:GOTO 400
490 AUDIOOFF:MOTOR OFF:RA=RA+1:IF PC=C THEN 510
500 FORD=1TO500:NEXTD:SOUND100,4:SCREEN0,0:CLS:PRINT@266,"BAD LUCK!!!":I
F RA=4 THEN 520 ELSE FORD=1TO2000:NEXTD:GOTO90
510 PLAY"T25V31O3ABCDEFGABCDEFGABCDEFG":CLS:PRINT@266,"WELL DONE!!!":PRI
NT@330,"YOU WIN $"PB*3:SCREEN0,1:PT=PT+PB*3:FORD=1TO2000:NEXTD:IFRA<4THE
N90
520 CLS:PRINT@264,"***GAME OVER***":PLAY"T25V31O2GFEDCGFEDCGFEDCGFEDC":F
RINT:PRINT:PRINT"YOUR TOTAL NOW $"PT:PRINT:PRINT:SCREEN0,1
530 FOR D=1TO2000:NEXTD:END
540 'OUT OF MONEY
550 A$=CHR$(143+96):CLS7:PRINT@262,"YOU"A$"ARE"A$"OUT"A$"OF"A$"MONEY";:S
OUND100,1:FORD=1TO2000:NEXTD:PRINT@480,"";:END
```

Grandprix
by Brian Cadge

Leopard

on ZX81

This is a game for the ZX81 with the 16K Ram. The program traps you in the jungle at midnight with a hungry leopard. You can only see the whites of his eyes and you have five bullets which are really more like guided missiles. Each bullet has a life of approximately 15 seconds before it explodes. The leopard moves about quickly from place to place.

Success in catching the leopard depends to some extent upon luck but also on the skill with which the operator moves about on the cursor keys. The moving display celebrates your success with the words 'Well done you are safe' but failure results in a moving display which gives the disgusting sound of a leopard munching its prey (or at least that's the intention!)

Program notes

Lines	
1	Complaints that the game is too difficult have forced the compiler to include the Rem line giving details of how to make it easier
25 to 90	Gives instructions and explains the game
200 to 220	Fills the screen with inverse spaces
230 to 270	Sets up the variables X and Y (position of moving bullet) G (length of time leopard stays in one place) Z (life of bullet) M (no of bullets)
280 to 220	Prints information showing position of bullet and its number. Sends program to subroutine 3000 for position of leopard's eyes
300 to 470	Loop for moving bullet each trip through the loop adds 1 to the variables G and Z, checks their values, limits the values of X and Y to prevent going off-screen and checks the position of XY in relation to AB (the position of the leopard)
1000 to 1110	This subroutine shows the explosion of the bullet, adds one to M (no. of bullets used), reduces Z (life of bullet) to 0 and returns
3000 to 3050	Changes the position of the leopard, signified by graphics character shifted E printed twice. Returns G to 0. G being the measure of the length of time the position of the leopard remains static
4000 to 4080	When M = 6 all bullets are gone. A moving display is set up to tell you what has happened
5000 to 5250	Gives a display showing the bullet hitting the leopard, gives the number of bullets used and celebrates with a moving display of congratulations!

```
  1 REM  TO MAKE THE GAME EASI
ER, CHANGE LINE 490 TO  IF Z=100
 THEN GOSUB 1000
 10 REM  LEOPARD
 20 REM  EVE GORTON
 25 PRINT TAB 8,"SPOT THE LEOPA
RD"
 30 PRINT AT 5,0,"MIDNIGHT IN T
HE JUNGLE... THERE IS A HUNGRY L
EOPARD AFTER YOU.....ALL YOU CAN
 SEE ARE THE WHITES OF HIS EYES"
 40 PRINT AT 10,3,"YOU HAVE 5 B
ULLETS - CONTROL KEYS 5,6,7 AND
8"
 50 PRINT AT 15,0,"A BULLET LAS
TS 15 SECONDS, THEN IT GOES BANG
"
 70 PRINT AT 18,0,"WATCH OUT-LE
OPARDS MOVE QUICKLY"
 80 PRINT AT 20,0,"PRESS 0 TO G
O ON"
 90 IF INKEY$<>"0" THEN GOTO 90
200 FOR N=0 TO 20
210 PRINT AT N,0;"
"
220 NEXT N
230 LET G=0
240 LET Z=0
250 LET M=1
260 LET X=20
270 LET Y=10
280 PRINT AT 20,10;" ";AT 21,10
;"BULLET NO ";M
290 GOSUB 3000
300 REM MOVING BULLET
310 PRINT AT X,Y;" "
320 LET G=G+1
330 LET Z=Z+1
340 PRINT AT X,Y;" "
350 IF INKEY$="7" THEN LET X=X-
1
360 IF INKEY$="6" THEN LET X=X+
1
370 IF INKEY$="5" THEN LET Y=Y-
1
380 IF INKEY$="8" THEN LET Y=Y+
1
390 IF Z=16 THEN GOSUB 1000
400 IF G=10 THEN PRINT AT A,B;"
  "
410 IF G=10 THEN GOSUB 3000
420 IF X<0 THEN LET X=0
430 IF Y<0 THEN LET Y=0
440 IF X>20 THEN LET X=20
450 IF Y>30 THEN LET Y=30
460 IF X=A AND Y=B OR X=A AND Y
=B+1 THEN GOTO 5000
470 GOTO 300
1000 REM BANG
1010 PRINT AT X,Y;"BANG"
1020 FOR J=0 TO 8
1030 NEXT J
1040 PRINT AT X,Y;"    "
1050 LET Z=0
1060 LET X=20
1070 LET Y=10
1080 LET M=M+1
1090 IF M=6 THEN GOTO 4000
1100 PRINT AT 21,10;"BULLET NO "
;M
1110 RETURN
3000 REM LEOPARD MOVE
3010 LET A=INT (RND*18)+1
3020 LET B=INT (RND*28)+2
3030 PRINT AT A,B;"  "
3040 LET G=0
3050 RETURN
4000 REM BULLETS GONE
4010 CLS
4020 PRINT AT 5,0;"ALL BULLETS G
ONE - YOU ARE"
4030 LET A$="LEOPARDFOOD - MUNC
H SLURP CHOMP"
4040 FOR X=0 TO 40
4050 PRINT AT 10,0;A$
4060 LET A$=A$(2 TO )+A$(1)
4070 NEXT X
4080 STOP
5000 REM DEAD LEOPARD
5010 PRINT AT A,B;"  "
5020 FOR J=0 TO 5
5030 NEXT J
5040 PRINT AT A,B;"  "
5050 FOR J=0 TO 5
5060 NEXT J
5070 PRINT AT A-2,B-2;"GOTTIM"
5080 FOR J=0 TO 20
5090 NEXT J
5100 PRINT AT 21,1;"NO.OF BULLET
S USED ";M
5110 LET A$=" WELL DONE -*- YOU
ARE SAFE -*"
5120 FOR X=0 TO 45
5130 PRINT AT 10,0;A$
5140 LET A$=A$(2 TO )+A$(1)
5150 NEXT X
```

GRAPHICS

Line 210	32 inverse spaces
Line 310	inverse *
Line 340	inverse space
Line 400	2 inverse spaces
Line 1040	4 inverse spaces
Line 3030	shifted E
Line 5010	2 inverse *s
Line 5140	2 inverse dollar signs

Leopard
by Eve Gorton

Four Up

on Spectrum

This game is based on the children's game Connect Four where you must try to get four in a row (vertical horizontal or diagonal) before the computer. The program can give you a tough time but not so tough that you can't win.

After the opening moves the Spectrum appears to be thinking — it keeps pointing to different slots which sometimes will have you byting your nails. It is fully automatic, will keep score and inform you of the winner.

```
5 REM FOUR UP BY Jim Walsh.
10 GO SUB 9000: GO SUB 3000
15 DATA 16,31,60,12,255,255,255,124,216,240,255,124,255,255,255,255,255,255
17 DATA 127,63,31,16,7,255,255,255,255,252,248,240,224,192,64,32
19 DATA 16,8,4,2,1,1,2,4,8,16,32,64,128
25 RESTORE : FOR n=0 TO 47: READ a: POKE 32600+n,a: NEXT n
30 [illegible]
50 DIM a(8,9): FOR n=1 TO 9: LET a(1,n)=3: LET a(8,n)=3: NEXT n
60 LET aa=0: LET you=0
100 CLS : BORDER 0: PRINT AT 2,0;: FOR n=1 TO 6: PRINT INK 2;"[illegible]"
 NEXT n
105 PRINT INK 2;"[illegible]"
110 PAUSE 20: FOR n=0 TO 2: PRINT PAPER 1;AT n,0;"
 NEXT n
115 PAUSE 50: FOR n=3 TO 21: PRINT AT n,0; PAPER 5;" ": NEXT n
120 PAUSE 20: FOR n=3 TO 21: PRINT AT n,27; PAPER 5;" ": NEXT n
125 PAUSE 50: BEEP .5,-20: PRINT AT 0,5; INK 0;"Press Any Key To start": PAUSE 0
130 PRINT AT 0,0; PAPER 6;"
 ": BEEP .05,25
134 [illegible]
135 LET go=1: LET r=RND*10+1: IF r>5 THEN LET go=1
137 LET I=0: LET J=6: LET found=0: LET move=0
140 FOR n=1 TO 200: NEXT n
240 [illegible]
250 LET move=move+1: LET go=go-1: IF move>42 THEN GO TO 1100
252 IF go=-1 THEN GO TO 300
255 PRINT AT 0,14; BRIGHT 1; PAPER 0; INK 1;"My Move": BEEP .28,31
257 PAUSE 100
258 PRINT AT 0,14; BRIGHT 0; PAPER 6;"
260 LET s/=1: LET z=2: LET x3=0
265 IF move<6 THEN GO TO 275
268 GO SUB 650
270 LET z=1: GO SUB 600
273 LET z=2: IF found=1 THEN LET a(y1,x1)=0
274 IF found=1 THEN GO TO 800
275 IF x3<>0 THEN GO TO 870
276 LET x=INT (RND*7)+2: IF a(2,x)<>0 THEN GO TO 276
277 LET y=2: LET x=x
280 PRINT AT 1,4; PAPER 5;" ";AT 2,4;" ";AT 1,3+((x-1)*3); INK 1; FLASH 1;"[illegible]";AT 2,3+((x-1)*3);"[illegible]": PAUSE 100 [illegible]
283 GO SUB 400
285 PAUSE 100: PRINT AT 1,3+((x-1)*3); PAPER 6;"  ";AT 2,3+((x-1)*3);"  "
290 GO TO 250
300 PRINT AT 0,10; INK 1; PAPER 0; BRIGHT 1;"Your Move": BEEP .05,35
302 PAUSE 100: LET s/=0
305 PRINT AT 0,10; BRIGHT 0; PAPER 6;"
309 LET c=1: LET d=15: LET x=5: LET y=2: LET z=1
310 PRINT PAPER 6; INK 0; FLASH 1;AT c,d;"[illegible]";AT c+1,d;"[illegible]"
315 PAUSE 1: LET z$=INKEY$: IF z$="" THEN GO TO 315
317 IF z$="8" OR z$="5" OR z$="0" THEN GO TO 320
318 GO TO 315
320 BEEP .2,10: PRINT AT c,d; PAPER 6;"  ";AT c+1,d;"  "
325 IF z$="8" THEN LET d=d+3
328 IF z$="8" THEN LET x=x+1
330 IF d>26 THEN LET d=24
331 IF x>8 THEN LET x=8
335 IF z$="5" THEN LET d=d-3
338 IF z$="5" THEN LET x=x-1
340 IF d<6 THEN LET d=6
341 IF x<2 THEN LET x=2
345 IF z$="0" THEN GO TO 355
350 GO TO 310
355 IF a(2,x)<>0 THEN GO TO 309
356 GO SUB 400: REM drop
358 GO SUB 700: IF found=1 THEN GO TO 1000
360 GO TO 250
400 REM drop
401 IF a(y+1,x)=0 THEN LET y=y+1
405 IF a(y+1,x)<>0 THEN GO TO 420
410 GO TO 401
420 LET a(y,x)=z
450 LET a=1: LET b=5
455 IF z=1 THEN LET in=6
460 IF z=1 THEN LET pa=1
465 IF z=2 THEN LET in=1
470 IF z=2 THEN LET pa=6
475 LET a=a+(y-1)*3: LET b=b+(x-1)*3
480 PRINT INK in; PAPER pa;AT a,b;"[illegible]";AT a+1,b;"[illegible]"
485 RETURN
500 IF s/=0 THEN RETURN
505 PRINT AT 1,d; PAPER 6;"  ";AT 2,d;"  "
510 LET d=6+INT (RND*6)*3
515 PRINT INK 1; FLASH 1;AT 1,d;"[illegible]";AT 2,d;"[illegible]": REM Graphics
520 PAUSE 5: RETURN
530 LET n=0: LET temp=0
535 LET t=a(y+n,x): IF t=z THEN LET temp=temp+1
540 LET n=n+1: IF z=t THEN GO TO 535
545 IF temp>=4 THEN LET found=1
546 IF temp>2 AND z=1 THEN LET x3=x
547 RETURN
550 LET n=0: LET temp=0
555 LET t=a(y,x-n): IF t=z THEN LET temp=temp+1
560 LET n=n+1: IF t=z THEN GO TO 555
565 LET n=1
567 LET t=a(y,x+n): IF t=z THEN LET temp=temp+1
569 LET n=n+1: IF t=z THEN GO TO 567
570 IF temp>=4 THEN LET found=1
571 IF temp>2 AND z=1 THEN LET x3=x
572 RETURN
575 LET n=1: LET temp=0
577 LET t=a(y+n,x+n): IF t=z THEN LET temp=temp+1
579 LET n=n+1: IF t=z THEN GO TO 577
581 LET n=0
583 LET t=a(y-n,x-n): IF t=z THEN LET temp=temp+1
585 LET n=n+1: IF t=z THEN GO TO 583
587 IF temp>=4 THEN LET found=1
588 IF temp>2 AND z=2 THEN LET x3=x
589 RETURN
600 LET n=0: LET temp=0
605 LET t=a(y+n,x-n): IF t=z THEN LET temp=temp+1
610 LET n=n+1: IF t=z THEN GO TO 605
615 LET n=1
620 LET t=a(y-n,x+n): IF t=z THEN LET temp=temp+1
625 LET n=n+1: IF t=z THEN GO TO 620
630 IF temp>=4 THEN LET found=1
632 IF temp>2 AND z=2 THEN LET x3=x
635 RETURN
650 LET found=0
655 FOR y=2 TO 7: FOR x=2 TO 8
660 LET t=a(y,x): IF t=0 THEN GO SUB 690
665 IF found=1 THEN GO TO 880
670 NEXT x: NEXT y
675 LET y=2: RETURN
690 IF a(y+1,x)=0 THEN RETURN
691 LET a(y,x)=z: GO SUB 700
692 IF found=0 THEN LET a(y,x)=0
693 IF found=1 THEN LET y1=y
694 IF found=1 THEN LET x1=x
695 RETURN
700 GO SUB 530: GO SUB 635
705 GO SUB 550
710 GO SUB 575: GO SUB 635
715 GO SUB 600
730 RETURN
800 IF x=2 THEN GO TO 875
802 PRINT AT 1,d; PAPER 5; INK 1;" ";AT 2,d;" ";AT 1,3+((x-1)*3); INK 1; FLASH 1;"[illegible]";AT 2,3+((x-1)*3);"[illegible]"
805 PAUSE 50
810 GO SUB 450
815 GO TO 1000
850 LET found=0: PRINT AT 1,d; PAPER 5;" ";AT 2,d;" ";AT 1,3+((x-1)*3); FLASH 1;"[illegible]";AT 2,3+((x-1)*3);"[illegible]": PAUSE 100: PRINT PAPER 6;AT 1,3+((x-1)*3);"  ";AT 2,3+((x-1)*3);"  "
860 GO SUB 400
865 PAUSE 100: GO TO 250
870 LET x=x3: GO TO 355
1000 IF z=1 THEN LET you=you+1
1002 BEEP .5,3: BEEP .2,0: BEEP 1,0
1005 IF z=2 THEN LET aa=aa+1
1010 IF z=1 THEN PRINT AT 0,11; BRIGHT 1; PAPER 0; INK 1; FLASH 1;" YOU WIN "
1015 IF z=2 THEN PRINT AT 0,12; BRIGHT 1; PAPER 0; INK 1; FLASH 1;" I WIN "
1020 FOR n=1 TO 1000: NEXT n
1025 PRINT AT 0,11; PAPER 6;"
1027 PRINT AT 11,1; PAPER 6; INK 0;"Me";AT 13,2;aa;AT 11,28;"You";AT 13,28;you
1030 LET a=1: LET b=5
1035 FOR x=2 TO 8: FOR y=7 TO 2 STEP -1
1037 LET a(y,x)=0
1040 PRINT PAPER 7;AT a+((y-1)*3),b+((x-1)*3);"  ";AT a+1+((y-1)*3),b+((x-1)*3);"  "
1045 LET r=INT (RND*10)+1: BEEP .02,r
1050 NEXT y: NEXT x: PRINT AT 1,0; PAPER 5;"
 ";AT 2,0;"
1055 GO TO 135
1100 PRINT PAPER 6; INK 0;AT 0,9;" Its a draw "
1105 FOR k=1 TO 775: NEXT k
1110 PRINT AT 0,9; PAPER 5;"
1115 GO TO 1030
3000 PAPER 6: INK 1: BORDER 6: CLS : PRINT AT 0,8;"FOUR 'S UP!! by Jim Walsh": BEEP 1,0: PAUSE 300: RETURN
9000 BORDER 7: PAPER 7: INK 0: CLS
9005 PRINT "  Beat the Spectrum to get four in the same vertical, horizontal or diagonal.","Press 8 to go right. Press 5 to go left and 0 to drop."
9010 PRINT AT 18,6; FLASH 1;"PRESS ANY KEY": PAUSE 0: CLS : RETURN
```

Four Up
by Jim Walsh

Accounts

on Spectrum

This program should be useful to those who have a building society account. It enables you to work out how much interest you would gain in a certain time, or the percentage of interest you gain for a certain time.

After entering the program you must *Poke* 16518 100 in order to give the variable Z in line 1 the value 100. This along with a lot of other memory saving techniques enables the program to fit into the 1K machine.

```
1 LET Z=CODE "?"
2 PRINT " ",,"SHOULD",,"1 INTEREST",,"2 PERCENTAGE"
4 INPUT E
6 IF E<>SGN PI AND E<>VAL "2" THEN GOTO PI
8 CLS
10 IF E<>SGN E THEN GOTO Z
20 PRINT "**INTEREST**" AT PI+PI,PI;"ENTER BALANCE:",
30 INPUT A
40 PRINT "£";A,,,"ENTER INTEREST RATE"
50 INPUT B
60 PRINT B;" PC",,,"OVER HOW MANY YEARS?",
70 INPUT C
75 PRINT C
80 LET X=INT ((Z*(B/Z*A*C)+VAL ".5")/Z
85 PRINT ,,"£";X;" INTEREST",,"£";A+X;" OVERALL"
90 STOP
100 PRINT "**PERCENTAGE**",AT EXP E NOT PI,"ENTER BALANCE",
110 INPUT A
115 PRINT "£";A,,,"ENTER INTEREST"
120 INPUT B
125 PRINT "£";B,,,"OVER HOW MANY YEARS?",
130 INPUT C
135 PRINT C,,,,,B/A*Z/C;" PER CENT INTEREST"
```

Accounts
by Mike Dipol

Running on Acorn 6502

***Gareth Jones** throws some light on the intricacies of the BBC's assembler*

Acorn has supplied an excellent assembler in the BBC machine's Rom. However the User Guide assumes the reader has a prior knowledge of 6502 machine code. For those Beeb owners who do not have this knowledge but are interested in machine code this article will hopefully throw a little light on the subject. Learning how to write simple machine code programs is easy once you have grasped the difference between machine code and Basic. The effort is well worthwhile.

The 6502 is an 8-bit processor, ie it can only deal with numbers in the range 0-255. It can, however, address 64K directly so 16 bits (2 bytes) must normally be used for addressing.

Numbers cannot be stored in variables as in Basic, they must be stored directly into memory locations one byte at a time. To do this the number must be in one of three registers: the Accumulator, X register or Y register (all 8 bits long). The instructions to store the contents of these registers are *Sta*, *Stx* and *Sty*. These instructions must be followed by an address to tell the computer where to store the number (different forms of addressing are obtained by using brackets and/or the X and Y registers to give indexed addressing.)

Status register

Another of the 6502's registers is the Status register. This cannot be used by the programmer directly, but the different bits are set or cleared by the processor according to the outcome of different operations. For example, if an addition was performed and the answer was over 255 the carry flag/bit would automatically be set to 1. You could then subsequently branch (BCS) to another part of your program.

Program 1 inverts the whole of the screen using Basic (see UG page 250 for *Eor*). Next it clears the screen and assembles the machine code version of invert. Note that it does not execute the code.

In line 70 the Basic variable *Start* was given the address of the first instruction by the assembler. If you now type in *Call Start*, control will be transferred from Basic to the code (note the *Return* subroutine *(Rts)* command at the end which passes control back to the Basic interpreter). You may notice that the machine code version is slightly faster.

Program notes — as in Basic you must use a counter to run through all the screen addresses. There is spare memory from &70 to &8F so &70 and &71 can be used to hold the 16-bit address. First you must *Load* the accumulator with &58 — the high byte of the start of screen memory, then store it in location &71 (the #&58 means the actual number (immediate addressing). *Lda* &58 loads in the number contained in location &58 (absolute addressing)). The low byte is then stored in &70.

If you are going to have a loop you must jump back to somewhere, hence line 110. Since you want to *Eor* each memory location with 255, first load the number into the accumulator, then *Eor* it with the number stored in the address given by your counter (&70 &71). The actual syntax for the address is (&70),y which takes the lowest byte from &70, the highest byte from &71 and adds the number in the Y register on to this, ie address=(?&70+(?&71*255)+Y).

The result of this operation is held in the accumulator so you must store it back into screen memory. In this example the Y register takes no part in the addressing (line 100 loaded it with 0) but it is necessary in the syntax of the instruction.

The next step is to increment the counter. First load the lower byte into the accumulator (line 150) then *Add* 1 with *Carry (ADC)* to this. Line 140 clears the carry initially.

The highest byte however must only be incremented when the lower byte overflows. Adding (0+carry) achieves this. The result is still in the accumulator even after storing the result in memory, therefore you can compare it with the number &80 (high byte of the end address). If they are not the same branch back to *Label*.

In the user guide there are references to certain routines being vectored. What this means is that when the computer wants to write a character to the screen, it puts the ASCII code of the character into the accumulator (A) then jumps to subroutine (JSR) &FFEE. At &FFEE there is a *Jmp* (&20E) instruction (Jump). The brackets serve the same purpose as in program 1, but this time no Y is needed so control is transferred to the address contained by &20E and &20F, namely &E1BB (the address of the routine to print the character). This seems a rather long way of going about it, a *Jsr* &E1BB would have done the same job. However, if you change the addresses in &20E &20F you can change the way the computer writes to the screen. This is what program 2 does.

Line 40 calls the subroutine to print the character. Since all of the various routines have a *Rts* at their end, control will be passed back to line 50. Everything sent to the screen now will be printed twice (the *Rts* at the end will this time pass control back to the program which called the modified print routine).

Lastly you must make &20E and &20F point to the routine. *Double* holds the address, so line 70 places the lower byte in &20E and line 80 places the highest byte into &20F (because of the way the 6502 is designed, you must put the lower byte before the higher byte — the assembler automatically changes round the two bytes when you specify a 16-bit address). This method will work wherever the code is assembled. Once you run the program there is no need to *Call* it since the machine will do it for you.

Program 2 demonstrates some of the possibilities of relatively simple machine code programs. Program 1 could be useful but it is slow for a machine code program.

```
5 REM ** PROG1 ** GLJ SEP 82 **
10 MODE4 FOR L=1TO100 DRAWRND(1280),RND(1024) NEXT
20 FOR X%=&5800TO&8000 ?X%=?X% EOR 255:NEXT
30 MODE4
40 FOR O=0TO1
50 DIM P%100
60[OPT O*3
70.START
80 LDA #&58:STA &71
90 LDA #0:STA &70
100 LDY #0
110.LABEL
120 LDA #255
130 EOR (&70),Y
135 STA (&70),Y
140 CLC
150 LDA &70:ADC #1 STA &70
160 LDA &71 ADC #0 STA &71
170 CMP #&80 BNE LABEL
180 RTS
190]
200 NEXT
```

```
5 REM** PROG 2 **
10 P%=&D00
20[
30.DOUBLE
40 JSR &E1BB
50 JMP &E1BB
60]
70 ?&20E=DOUBLE AND &FF
80 ?&20F=(DOUBLE AND
   &FF00)/&FF
```

Into the subset

Experiment by altering the values being added (just *Poke* new values into 17154 and 17156 and *goto* 220) Alternatively put the result somewhere else — say 17153 See how it changes the program? Try adding 240 to 100 (decimal) The result is not 340! Why? Think about it in binary

```
240        1 1 1 1 0 0 0 0
100      + 0 1 1 0 0 1 0 0
         -----------------
    ┌───── 0 1 0 1 0 1 0 0  =  84
    │    -----------------
    ↓      1 1
    1
```

The sum generates a 1 in the ninth bit which cannot be held in an 8-bit byte so it falls off the end The quoted result is too small by the value of that ninth bit — 256 No check has been made no helpful error message printed When you write machine code you are on your own What you do not test for you do not find out about

Here s how to modify the *loader* program to accept hex, by combining it with the decimal hex converter in *Machine Code* September 23

Change lines 120 130, 140, 150 to

```
120 INPUT C$
130 IF C$="S" THEN GOTO 160
140 PRINT C$
150 POKE A 16*(CODE C$(1)-28)+CODE
    C$(2)-28
```

The procedure is exactly as before but now at each input you key in the hex code 3E then 04 then 06 etc Do not omit the zeros Use ' S ' to end the inputs in place of the previous "negative number" delimiter.

In the previous description we assumed you might only have 1K of memory Machine code is of course a useful space-saver with 1K, but anyone interested in it is likely to have 16K Further, some of our later routines using the display file need at least 4K To reserve a 256-byte attic in 16K, proceed as follows

```
POKE 16389 127
NEW
```

Now *load* in the machine code Replace 4300 hex by 7F00 hex and 17152 decimal by 32512 decimal From now on we are only going to give the hex codes for which you can use the modified *loader* program

It is a terrible nuisance that the ZX81 needs a *new* before it recognises changes to *ramtop* You are half way through typing in a basic program with some machine code to accompany it later and you have forgotten to allocate memory

Using what we have told you so far all you can do is *save* on tape reset *ramtop* then *load* back in and continue But there *is* a way to avoid this by using a Rom routine

Suppose you want to allocate a 256-byte attic, leaving your precious Basic intact From the keyboard type

```
POKE 16389 127      (reserve space)
PRINT USR 1040      (call from ROM)
```

You will get a listing and the program will halt Restart with Run (this technique loses your variables anyway) That s it For different sizes of attic change the 127 (and *Poke* 16388 with the junior byte if this is not zero)

You can use this in a program but the program will halt after the *USR* 1040 and need a manual restart And directly entered variables will be lost

We are not going to describe one of the 694 opcodes the Z80 has — that would be tedious and unnecessary Instead we will look at a subset of 30-odd types of instruction (covering about 230 actual commands) Unfortunately, not all of them can use all the addressing modes Here is a quick reference table showing with which instructions can use what

Address Mode	LD	ADD ADC SUB SBC AND OR XOR CP	INC DEC SLA SRA SRL	JR JRC JRNC JRZ JRNZ DJNZ	JP	JPZ JPNZ JPC JPNC JPP JPM	LD	ADD ADC SBC	INC DEC PUSH POP
Register	LD r s	ADD A r	INC r					ADD HL r	INC r
Immediate	LD r n	ADD A n			JP nn	JPZ nn	LD r nn		
Direct	LD A (nn) LD (nn) A						LD HL (nn) LD (nn) HL		
Indirect	LD A (HL) LD (HL) A	ADD A (HL)	INC (HL)		JP (HL)				
Indexed	LD A (IY+d) LD (IY+d) A	ADD A (IY+d)	INC (IY+d)	JR d					

8-bit operations (LD to JR columns); 16-bit operations (JP to INC/DEC/PUSH/POP columns)

The notation is the table needs some explanation Some of the opcodes will be unfamiliar, but we will deal with those later Otherwise, the conventions are

1) Each entry in the table shows an example of the format of the instruction type Any of the other opcodes in that column could be substituted
2) "r" or "s" denotes any register Whether this is an 8-bit or a 16 bit register depends on which part of the table the instruction is in For instance, in the *Ld* r s instruction, r and s are any 8-bit registers (A B, C D E H or L) but in *ADD HL* r ' r is one of *Bc De Hl Sp*
3) "n" is any 8-bit number "nn" is an 16-bit number
4) If a register is explicitly stated as in *Ld A* (nn) then this is the only register which may be used for this purpose

This is a wild oversimplification Sometimes other registers are usable But the set of instructions we have shown are *always* OK and you can worry about extending your vocabulary of instructions when you are handling this lot confidently

5) ' d ' is any 8-bit number but it is always added to some 16 bit value In other words it is an indexing displacement

Now let s look at the new opcodes

And

This operation takes the contents of the *A*-register, and another 8-bit field, and examines these bit by bit Only if corresponding bits are both "1" does it put a "1" back in this position in the *A*-register Otherwise it inserts a '0'

For instance, *And A* 07 has the following effect

```
A-register before the operation    0 0 1 1 0 1 0 1
07                                 0 0 0 0 0 1 1 1
A-register after the AND           0 0 0 0 0 1 0 1
```

See how the junior three bits have been transmitted? So you can use *And* to select a portion of a byte

OR

This works in a similar way to *And* but this time the resulting bit is a "1" if either of the initial bits is a "1" So *Or A* 05 gives

```
A-register before                  0 1 0 0 1 0 1 1
05                                 0 0 0 0 0 1 0 1
A-register before                  0 1 0 0 1 1 1 1
```

Now certain bits are being forced to ' 1 ' regardless of their original value

Xor

Here the initial bit values must be different for the result to be a "1" *Xor A* B3 gives

```
A register before                  0 1 0 1 1 0 1 0
B3                                 1 0 1 1 0 0 1 1
A-register after                   1 1 1 0 1 0 0 1
```

It is particularly useful for flipping a register from 0 to 1 and back again If a *A*-register contains 0 to start with every time the instruction *Xor A* 01 is executed the value in the *A*-register will flip (0 to 1 back to 0, back to 1 and so on)

Cp

This is the "Compare" instruction The contents of the *A* register are compared with those of another 8-bit field That raises a problem, though — how is the result of the comparison signalled?

This is what the *F* (or *flags*) register is used for Each bit of the *F*-register holds some information about the effect of the last instruction to alter them (Not all instructions do alter them)

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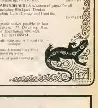
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Plotting on micros

Tim Langdell explains how to create user-defined graphics characters



The Dragon 32 does not have any easy way to allow you to create your own graphics characters unlike machines such as the Spectrum However, using *Get* and *Put* you can store your characters created by plotting to the screen, and place them anywhere on the screen

One advantage this system can offer on the Dragon is that you are not restricted to 8 by 8 character squares, as on other machines Since the character is stored in an array it can be virtually as small or as large as you wish For simplicity though I will restrict myself to an 8 by 8 character for space invaders as an example

The first stage is to plot the points which make up the character onto the screen using *Pset* in asy *Pmode* 4 I have chosen *Pmode* 4 because it gives you the maximum resolution available to define detailed characters The program requires you to type in the character as 8 rows of 8 zeros and ones (pressing *Enter* between each digit) and then translates this pattern of zeros and ones into the character you have designed The choice of zeros and ones was made to enable you to get an idea of how the graphic character will appear

Lines 120 to 150 do the actual plotting on the screen in a box 8 pixels by 8 pixels in size Line 160 uses a *Get* statement to store the box containing the character in an array *(C)* In the first bracket of the *Get* statement is the co-ordinate of the upper left-hand corner of the box The second bracket contains the co-ordinate of the bottom right hand corner of the box

Once the graphic is stored as the array 'C you can clear the screen *(PCLS)* and place the graphic anywhere using a *Put* statement This statement in line 180 is, as you can see very similar to the *Get* statement — with the contents of the brackets referring to the two corners of the new box s position

The problem with using *Pmode* 4 is that you can only have either white (buff) and black or green and black (with *Screen*1, and *Screen*1 0 respectively) To get some colour into the game you would need to use *Pmode* 3 But in *Pmode* 3 the resolution is exactly half as good and you will need to design your characters with care The zeros and ones to *Input* for this program to get a space invader are

```
00111100
01011010
01111110
00111100
00011000
00100100
01011010
00000000
```

If you do not wish to design your own character but wish to use one already planned then you might be better advised to employ *Read* and *Data* In this case you might consider storing the co-ordinates for the *Pset* statements in the form of *Data* and use a *For/Next* loop to *Read* the *Data* onto the screen in the form of *Pset* dots Thus the form would be

```
10 FOR X   1 TO 3
20 READ A  READ B
30 PSET (A B 2)
40 NEXT
60 DATA 10 10 10 11 10 12
```

The final part of the formula, to put the character on the screen and move it about involves *Putting* the character at a position and then a moment later *Putting* the same character at that position as *Reset* (which *Resets* the points which were *Set* before — ie blanks them out) This *Put* statement will thus look like this

```
PUT (110 110)    (118 118) C RESET
```

The character is then *Put* in the next position on the screen, cleared again and so on

```
1 REM USING GET AND PUT
2 REM FOR CHARACTER DEFINITION
1Ø DIM A$(9,9)
2Ø FOR N=1 TO 8:FOR M=1 TO 8
3Ø INPUT A$(N,M)
4Ø NEXT M
5Ø FOR T=1 TO 8: FOR S= 1 TO 8
6Ø PRINT A$(T,S);:NEXT:PRINT:NEXT
7Ø NEXT N
8Ø PMODE 4,1
9Ø PCLS
1ØØ SCREEN 1,1
11Ø DIM C(9,9)
12Ø FOR X=1 TO 8: FOR Y=1 TO 8
13Ø LET K=Ø: IF A$(X,Y)="1" THEN K=1
14Ø PSET(9+X,9+Y,K+1)
15Ø NEXT: NEXT
16Ø GET(1Ø,1Ø)-(18,18),C
17Ø PCLS
18Ø PUT(11Ø,11Ø)-(118,118),C
19Ø GOTO 19Ø
```

Common characters

1 1 Unifile/Spectrum page

Sooner or later most micro owners realise that their new digital friend comes into its own when it is storing information processing it and presenting it in ways that would be laborious if done manually. They soon begin the task of writing simple programs which will store their friends names and addresses or catalogue their stamp album. They may end up with half a dozen programs all of them using roughly the same method but working on different types of information. In this series of extracts from *The Working Spectrum*' we examine how a single program can be written to cover a variety of filing tasks without the need for constant re-writing every time a new usage comes along.

Before we write the program we must decide on an economical way of storing the data we wish to file. Small programs can afford to fudge this issue since they are unlikely to make use of all the available memory anyway. Such a small program might for instance declare an array with dimensions of 50,4 20. This would allow the storage of up to 50 entries each with four constituent items each being up to 20 characters long. The advantage of this is that each entry to the file would be clearly identifiable since entry X would be made up, if the array were called A$, of A$(X 1) A$(X 2) A$(X 3) and A$(X 4)

The disadvantage of this method is that for most filing uses it is likely to result in an enormous waste of space within the limited amount of memory available. The reason for this is simply that the length of the fixed space you allocate to each item must be adequate to the longest item you are likely to input. If, for instance you want to store the names of your friends and one of them is graced with the surname Farquarson-Smythe then you will have to set aside at least 17 characters for every surname, despite the fact that the rest of your friends are nowhere near so impressively named. The space allocated to most of the names would be more than half empty.

This is a problem encountered by any storage method which allocates a fixed amount of memory to each item regardless of its size. But if each entry is not to be allocated a fixed amount of space then the file in which the data is stored will not be divided up in any regular way. This makes its difficult for the program to keep track of the position of individual entries or even to identify where one entry ends and another begins.

Take the following example of two entries in a file which have been allocated precisely the right amount of space

S M I T H J O H N 3 3 1 2 5 5 8 4 5 6 7 7 H I G H
STTHOMASBILL45109567851EDEN AV

You probably had no difficulty in identifying the names of the two men, but your Spectrum is not as familiar as you with common surnames. Even you probably did not guess that each name is followed by the age file number telephone number and street number of the man in question. How is the program to identify each of these given that any of them can vary in length?

The answer to such problems is normally provided by a combination of indicators and pointers. Indicators are markers set into the main body of data which allow the program to identify the length of the items which make up an entry. Pointers are normally set outside the main body of data. They consist of a list of the positions in memory of all the entries enabling the program to jump into the middle of a long and complex file and unerringly find the first character of the desired entry.

The program below uses indicators and pointers to manage a file made up of 25 000 characters made up of perhaps hundreds of separate entries all packed together in a seemingly random way. The program is called **Unifile**. I hope it will come to play a valuable part of your program library. More importantly the techniques employed are essential tools for everyone who wants to pack his Spectrum, 16K or 48K, with the maximum amount of information.

Module 1 1

As a rule of thumb a utility program that does not commence with a fairly clear-cut menu of the functions available is a bad program. If you do not agree with this now you certainly will some time when you have to return to a complex but useful program which you have not used for some time and have to spend hours going through the listing trying to work out just what you have to do to make the program work for you

```
1000 PAPER 7: CLS: BORDER 7: INK 0: PAPER 0: PRINT PAPER 2, "UNIFILE"
1010 PRINT "FUNCTIONS AVAILABLE"
1020 PRINT "      1)SET UP NEW FILE"
1030 PRINT "      2)ENTER INFORMATION"
1040 PRINT "      3)SEARCH/DISPLAY/CHANGE"
1050 PRINT "      4)STOP"
1060 PRINT "PLEASE ENTER WHICH YOU REQUIRE"
1070 INPUT Z$
1080 CLS
1090 IF Z$="1" THEN GO SUB 1010
1100 IF Z$="2" THEN GO SUB 1440
1110 IF Z$="3" THEN GO SUB 2100
1120 IF Z$="4" THEN GO SUB 1150
1130 CLS
1140 GO TO 1000
1150 PRINT AT 10,8; INK 7; PAPER 2; "FILING SYSTEM CLOSED"
1160 BEEP 2,2
1170 INPUT "Have you input new information you wish to save? (Y/N)",a$: IF a$="N" THEN STOP
1190 SAVE "UNIFILE": PRINT "Rewind tape, then press any key to VERIFY": PAUSE 0: VERIFY "UNIFILE": STOP
```

In this module the user is requested to choose between four numbered functions. No particular attempt is made to guard against mistaken inputs. Mistakes at this stage are not serious. If a number or character other than 1-4 is input, the program ignores it. The module also contains as one of the four menu choices the *Stop* function. This serves the purpose of marking an end of the use of the program and reminds the user to re-record any new data which has been entered.

Commentary

Line 1000 Every program on the Spectrum which is not going to be in black on white needs to declare somewhere near the start the colours to be used for

a) the border around the screen
b) the screen
c) the ink with which the characters appear on the screen

There are three separate *Paper* instructions in this line. The first instruction stands alone and with the CLS command sets the screen to white. In the second instruction the *Paper* colour is set to black so that the menu stands out boldly from the white background. The third *Paper* instruction is tied to a *Print* instruction. It makes no permanent difference to the paper colour but ensures that the word Unifile is printed on a red background.

It is important that you can distinguish between those colour commands which stand alone and set a colour, and those colour commands which refer only to the single *Print* statement to which they are tied. A single *Print* statement can have every characteristic set by such tied commands. For example

PRINT FLASH 1 OVER 1 INVERSE 1 PAPER 7 INK 0 HELLO

None of these colour commands will have any effect on Print statements in other parts of the program.

Line 1070 When you have an input to a program menu do remember to check that the variables you use are not duplicated in other parts of the program.

Line 1080 The menu is printed on white paper in bold black strips. But the last *Paper* command sets the background to black so this *CLS* command sets the whole screen black. It remains black until the program returns to the menu.

Line 1190 For any data storage program it is far more convenient to have a *Save* instruction built into the program rather than having to enter it in direct mode every time new data has been added.

Testing Module 1.1.1

A rough and ready test of the module is simply to *Run* it and enter numbers in the range 1 to 3. The program should then stop with the report 0 OK followed by the appropriate line number from 1090 1110. Input of 4 should result in a prompt to *Save* and then *Verify* the program. Any other input should be ignored.

More of the Unifile program will be presented next week.

This is an extract from *The Working Spectrum*, by David Lawrence (price £5 95) published by Sunshine Books, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Is there anything about your computer you don't understand, and which everyone else seems to take for granted? Whatever your problem *Peek* it to Ian Beardsmore and every week he will *Poke* back as many answers as he can. The address is *Peek & Poke, PCW*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

OLIVER ASKS FOR MORE

Jason Derrs of Rosehill Way Guildford, writes

Q **I have a Vic20 and want to expand it. But, as I am limited to my pocket money, I would like to know if there is any other way of adding memory, apart from buying the super expander. I can borrow a soldering iron if necessary. Is there anyone who makes a kit for extra memory, preferably more than 3K? If not, is there any way I can add the extra memory myself?**

A This is the sort of question that needs a whole article in answer. I do know that 2114 chips, such as the Vic uses, have been 'Piggy backed', so as to effectively double the memory available to the user. However, this was done on a ZX80, I do not know if it has been tried on the Vic.

As there seem to be three unused control lines on the unexpanded Vic, it may well be possible to add 3K yourself, though this would void your guarantee. Unfortunately I do not know how you should go about adding 3K on your own. Does anyone have any ideas?

KACK-HANDED

Paul Thompson of Rowan Drive, Newbury Berkshire, writes

Q **In February I bought a Vic20 after selling my ZX81. I would like to know if there is a numeric keypad available for it, with a built-in *Return* key. But, as I am left handed, it would have to have enough cable to reach around the left hand side of the machine.**

A The Vic keyboard is an 8 × 8 matrix. The only number pad I know about is made by Dk'tronics for the ZX81. It costs £10 and should be possible to convert to the Vic20.

Alternatively, it should be possible to make one as described by Stephen Adams in his book *20 Simple Electronic Projects for the ZX81 and other computers*. The lines that you will have to deal with are line 7, which will give you the even numbers and line 8, which will give you the odd digits. *Return* is line 1, H. The keyboard connectors for the Vic are on the left as you look at the computer so the length of wire you will need should not be a problem.

But such a conversion, unless it can be done through your Commodore dealer, will void your guarantee.

LANGUAGE SPECIFICATIONS

Joe Laine of Yew Road Stockport, writes

Q **I am very interested in the new Jupiter Ace, but I am unsure whether or not to buy it. I was going to get a ZX81 or Spectrum to learn on, because I am going to start learning computing at school soon. What I want to know is, will I have to learn two languages, one at school and one on a Jupiter Ace? Also will there be software coming out for the Ace? I do not want to buy a computer that has no software.**

A The Jupiter Ace has caused quite a lot of interest, and not a small amount of decision taking. It is not an easy choice to make if you want to buy a computer, even if you do believe that Forth is a better language than Basic.

What you say about school is very important. I know that last year the London Board specified any high level language for the O-level but only Basic for the A-level. This year the AEB has not specified Basic only. The thing to do in this case is to talk with your teachers, find out what the syllabus asks and what they are going to teach. While an increasing number of staff are becoming computer literate I doubt if many of them are conversant with Forth.

My worry with the Ace is that it is in a Catch 22 situation where everyone is waiting for 'Everyone Else' to buy the machine, so that it generates enough interest for software companies to write programs for it. I feel that it is a very good choice for a second machine, and I can see it picking up some extra trade if the Spectrum problems continue. As to whether you should make it your first choice — I would again suggest you talk to your teachers before deciding.

BAR CODE DEVICE

Dermott Bicker of Skipton Street, Morecambe Lancashire writes

Q **Is it possible to use a bar code to program computers. I have seen this idea used with an electric organ to play tunes. Would it be a quick and easy method of programming simple 1K games on the ZX81?**

A This can be done. Apparently a device to use a bar code has been marketed in the United States by Mindware. Unfortunately, I have no other details. As far as I know, there is no comparable device available over here.

The address of Mindware is 15 Tec Circle, Natick, Mass 01760, USA.

MODULATING IMAGING

Rodney Bennett of Oxford Gardens, London, W10, writes

Q **I have a ZX81 and have recently acquired a video recorder, an excellent Sony C5. However, when I tried to use the ZX81 through my video recorder, replacing the aerial input in the normal way, the result was a much inferior screen image. I have had to return to feeding my ZX81 directly into the television set.**

This is a pity, as I had hoped that one use of the ZX81 would be to generate captions that could be used on video tapes. This is possible but only with a very poor quality screen image. Is there any way to improve this?

Also I am hoping to use my Spectrum (when it arrives) for the same purpose. Will I find the same problems?

On a related subject, I find it almost impossible to keep my television set tuned so that I get the best possible image from my computer without having to adjust it each time I use it. I have reserved a special channel but this does not seem to help. Is there any way around this?

A I think this problem is due to the fact that both machines are using the same RF signal. Like the computer a video has an in-built modulator, and it is almost an industry standard to pre-tune these to channel 36. I do not know the Sony C5 model specifically but is there a small screw visible whereby you can slightly re-tune its modulator?

If you can do this and then fine tune your ZX81 or Spectrum to the one on the video.

As regards the re-tuning of your ZX81 in normal use, the problem you have is so common that it is usually considered to be just part of the setting-up routine. If you use more than one computer on a single set you will find that a signal does tend to wander off station slightly.

BROADCASTING CONFUSION

I Baker of Kingsman Street, Woolwich London writes

Q **I have ordered a Spectrum, and have been following the correspondence and articles about television and video. However, I am now more baffled than ever.**

What is the difference between video and television? Are videos available on retail? Is there any particular video or television that works well with the Spectrum?

A These two words are easy to confuse. Essentially a television is a screen display that has been *tele*d. That is it has been broadcast and the material has come across the airwaves. This signal then has to be picked up and translated into the picture you see.

A video display does not have to go through this process. The display you see is fed directly into the television. Thus a computer gives a video picture when plugged in to a domestic television. A monitor cannot receive broadcast signals. It boils down to the different ways in which a signal gets to the cathode ray tube which gives the screen display.

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Brain teasers

by Gordon Lee

You are probably familiar with the sliding puzzle shown below which can be found in most toyshops.

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	■

It consists of a grid of 15 plastic squares which can slide freely around in a frame. The object of the puzzle is to rearrange the squares to form different patterns or to restore their order after they have been jumbled at random.

One of the earliest brain teasers using this puzzle involved lifting out the two tiles 14 and 15 and swapping them over. The task was then to rearrange them — by sliding only — to their original order. This problem is in fact insoluble since the exchange of two tiles is said to alter the polarity of the puzzle. There is no way that this can be reversed simply by sliding tiles.

If we remove all the tiles and replace them at random there are 20 922 789 888 000 different starting positions possible. The first tile can be placed in any one of 16 positions, the second in any of 15, and so on. The total number of starting positions given above is in fact 16! or 16 factorial (16! = 16x15x14x13x12x11x10x9x8x7x6x5x4x3x2x1x = 20 922,789 888 000.)

Only half of these starting positions can successfully be rearranged into the correct numerical order.

The Rubik cube has similar properties, but it contains 12 separate cycles — not two. If the elements of a Rubik cube are reassembled at random there is only a 1 in 12 chance that the cube can be completed. Of the 43 252 003 274 489 856 000 possible configurations of the cube, only 3 604 333 606 207 488 000 of them can be solved — still rather a formidable number.

An interesting variation uses letters instead of numbers.

R	A	T	E
Y	O	U	R
M	I	N	D
P	A	L	■

This forms the basis of a cunning trick. Show the puzzle to your friends, pointing out the wording and the two paired rows of differently coloured tiles. In full view, slide the tiles about and ask them to restore the original order. Try as they might, the closest they can get is 'Rate your mind pla'.

The catch is in the polarity of the puzzle. When you rearranged the tiles, apparently at random, you move the R from the word 'Your' up to replace the R from 'Rate'. Your friends naturally leave the R from 'Your' in the top left as the start of the word 'Rate'. Unknown to them this reverses the polarity of the puzzle making it insoluble.

Puzzle No. 31

1	9	2
3	8	4
5	7	6

In this grid the middle number (384) is twice the top one (192) and the bottom number is three times the top one. Each number has three digits and no digit is used more than once. How may other sets of numbers can be formed with these conditions?

Solution to Puzzle No 5

Using the standard technique for identifying primes, we check the odd numbers in sequence, counting them off into successive groups. The count C is started at 1 to account for the first (and only) even prime 2.

Line

```
 10 LET C=1
 20 LET M=1
 30 LET T=3
 40 FOR N=3 TO (SQR T)+5
 50 IF T/N-INT(T/N)=0 THEN GOTO 80
 60 NEXT N
 70 LET C=C+1
 80 LET T=T+2
 90 IF T>M*1000 THEN GOSUB 200
100 GOTO 40
200 PRINT M*1000-1000 "TO" M*1000 "CON
    TAIN" C "PRIMES"
210 LET M=M+1
220 IF M=11 THEN STOP
230 LET C=0
240 RETURN
```

This gives us the answer:

1	TO	1000	contain	168	primes
1000	TO	2000	contain	135	primes
2000	TO	3000	contain	127	primes
3000	TO	4000	contain	120	primes
4000	TO	5000	contain	119	primes
5000	TO	6000	contain	114	primes
6000	TO	7000	contain	117	primes
7000	TO	8000	contain	107	primes
8000	TO	9000	contain	110	primes
9000	TO	10000	contain	112	primes
0	TO	10000	contain	1229	primes

Winner of Puzzle No 25

The winner is Ms H Eshun, Wolfe House, London W12, who receives £10.

ZIGGURAT

The Monkey Puzzle

It is worth wondering how people's minds work and how, in particular, your mind works. Seymour Papert (in *Mindstorms*, 1980) poses the following puzzle: "A monkey and a rock are attached to opposite ends of a rope that is hung over a pulley. The monkey and the rock are of equal weight and balance one another. The monkey begins to climb the rope. What happens to the rock?"

There are three possible answers to the question: the rock goes up, goes down, or stays where it is — which is correct?

Papert notes that three quarters of several hundred physics students at MIT gave wrong answers or were unable to make up their mind. I have asked people from many different occupations, of many different ages, and the ability to arrive at the correct response seems to be unpredictable. Obviously the correct answer is that the rock goes up: those who were right, work out why you were right, and those who were wrong, try to work out why you were wrong.

This is, in essence, a very simple task, and it is only the solver who makes the task complex: the rock must rise because the monkey is pulling on the rope. Asking people to justify incorrect answers is very illuminating. Those who have a knowledge of physics — sometimes dimly remembered — often talk about conservation of energy so that if the monkey goes up the rock must go down, or sometimes they talk about inertia, so that the rock must stay where it is.

Sometimes people think that the rock must go up, but then think that this is too obvious so it must be one of the other solutions — these are people who are not sure of the solution and naturally distrust easy answers.

What else can we learn from this example? One conclusion that Papert himself draws is that most (ie more than half) people cannot see the wood for the trees, that is, the structure of the problem is lost in the detail. When the problem is seen as a whole — after all, the rock is attached to monkey by the rope — the answer is obvious, but if attention is focused on to the rock (as it often is) then the integrity of the system is violated.

This is the way many people program: they are so concerned with the intricacies of tiny portions of programs that the total way the program is designed is highly wasteful and confusing to follow.

A program is designed, but for many programmers the design is unknown to the designer: the program just grows from a few lines typed in at the keyboard to a vast unwieldly monolith. A programmer is a designer, a programmer is an architect whose building bricks are ideas, and a program is only as good as the ideas it contains. If a program is very long and complex, then that program is either having to deal with a long and complex task, or it is badly written (or it might lie somewhere between these extremes).

When we try to evaluate programs, therefore, we should use design criteria and that usually means that the programmer needs to have had an appreciation of the program as an entity, an entity which has certain distinct parts or modules. Some languages are supposed to promote better programming practices than are other languages, but usually 'better' seems to mean neat and tidy (not a bad thing in itself) and the wholeness is still lost.

The best designed programs do not come from a particular language, they come from programmers who understand the underlying structure of the problem for which they are writing a program. It is also a question of understanding what is the problem.

To write a program to use graphics to show addition in practice is not difficult. What are we to make, however, of a program for infant school children which puts three yachts on the screen, two cars, and five houses, and then tells the children that 3 + 2 = 5?